Port Tobacco River Watershed Characterization

April 2006

In support of Charles County's Watershed Restoration
Action Strategy for the Port Tobacco River Watershed

DEPARTMENT OF THE ENVIRONMENT

Montgomery Business Park Center
1800 Washington Boulevard, Suite 540
Baltimore MD 21230-1718

Product of the Maryland Department of the Environment
In Partnership with Charles County

TABLE OF CONTENTS

CONTRIBUTORS

Local

Karen Wiggen, Charles County Department of Planning and Growth Management
David Gardiner, Port Tobacco River Conservancy

State and Federal

Maryland Department of Natural Resources (MDNR): Ken Shanks, Lynn Davidson,

Maryland Department of the Environment (MDE): Denise Clearwater, Kathy Brohawn, and Mario Cora.

Primary Authors and Editors: Kathleen Ellis, Rita Bruckler, Danielle Lucid, MDE; Ken Shanks, MDNR, (Green Infrastructure and other text).

LIST OF MAPS AND TABLES

LIST OF APPENDICES

ACRONYMS

303(d) list – List of impaired waters
BIBI – Benthic Index of Biotic Integrity
BMP – Best Management Practices
C2K – Chesapeake 2000 Agreement
CCA – Coastal Conservation Association
COMAR – Code of Maryland Regulations
CREP - Conservation Reserve Enhancement Program
CRP - Conservation Reserve Program
CwiC - Chesapeake 2000 Watershed Commitments
EPA – Environmental Protection Agency
EQIP - Environmental Quality Incentive Program
FIBI – Fish Index of Biotic Integrity
FIDS - Forest interior dwelling species
GIS – Geographic Information Systems
IBI – Index of Biotic Integrity
MACS - Maryland Agricultural Cost-Share program
MBSS – Maryland Biological Stream Survey
MDE – Maryland Department of the Environment
MDNR – Maryland Department of Natural Resources
MGS – Maryland Geological Survey
MPN – Most Probable Number
NPDES - National Pollution Discharge Elimination System
PPSP – Power Plant Siting Program
PTRC – Port Tobacco River Conservancy
RTE – Rare, Threatened or Endangered species
SAV – Submerged Aquatic Vegetation
SCA – Stream Corridor Assessment
STORET - STOrage and RETrieval
TMDL – Total Maximum Daily Load
USGS – United States Geological Survey
WRAS – Watershed Restoration Action Strategy
WSSC - Non-Tidal Wetland of Special State Concern

INTRODUCTION

Watershed Planning Background

As a foundation for watershed monitoring, analysis and planning, the State of Maryland defined over 130 watersheds that cover the entire State in the 1970s. In 1998, the Maryland Clean Water Action Plan presented an assessment of water quality conditions in each of these watersheds. Based on these assessments, it also established State priorities for watershed restoration and protection. In 2000, the Watershed Restoration Action Strategy (WRAS) Program was initiated as one of several new approaches to implementing water quality and habitat restoration and protection. The WRAS Program solicits local governments to focus on priority watersheds for restoration and protection. Since inception of the program, local governments have received grants and technical assistance for 25 WRASs in which local government, with input from citizens, identifies local watershed priorities for restoration, protection and implementation.

Port Tobacco River WRAS Project

Charles County, one of five counties participating in the 2005 WRAS program, has selected the Port Tobacco River Watershed (Basin number: 02140109) for protection and restoration. The Port Tobacco River is a tributary of the Potomac River and is part of the Lower Potomac Tributary Strategy Basin (Map 1: Port Tobacco River Watershed). It is downstream of La Plata and includes the town of Port Tobacco (Map 2: WRAS Project Area).

Port Tobacco River watershed is prioritized in Maryland's Clean Water Action Plan (1998) as both a Category 1 watershed indicating that it is in need of restoration and as a Category 3 watershed indicating that it is a pristine or sensitive watershed in need of protection. Because the selection criteria used for Category 1 (Restoration) and Category 3 (Preservation) are not the same and because land use and related factors may vary considerably within a large watershed, many of the State's watersheds are identified as both Category 1 and 3 watersheds. These watersheds show signs of stress or degradation but still contain pristine or sensitive natural resources.

The County is working on a WRAS project to be completed in 2006. Charles County's project is intended to dovetail with existing efforts to protect the watershed. Charles County WRAS will identify and prioritize local restoration and protection needs associated with water quality and habitat. To support this effort, the Maryland Department of the Environment (MDE) has provided grant funding and technical assistance, which includes production of this Watershed Characterization.

Purpose of the Characterization

In support of the WRAS project, the Watershed Characterization helps to meet several objectives:

- Summarize available information and issues,
- Provide preliminary findings based on this information,
- Identify sources for more information or analysis,
- Suggest opportunities for additional characterization and restoration work,
- Provide a common base of knowledge about the watershed for government, citizens, businesses and other interested groups.

The Watershed Characterization adds to other efforts that are important for the County's WRAS project:

- Local investigation by the County
- Stream Corridor Assessment, in which State personnel physically walk the streams and catalogue important issues.
- Synoptic water quality survey in which water samples are collected and analyzed for nutrients and other substances.
- Technical assistance and assessment by partner agencies or contractors.

More Sources of Information

The reference section provides more detailed information that is only very briefly summarized here. The WRAS Program Internet home page has additional information on the program and an index of available electronic copies of WRAS-related documents that can be downloaded free of charge. Available documents include detailed program information, completed WRAS strategies, stream corridor assessments, synoptic surveys and watershed characterizations. Please visit the WRAS Home Page at: http://www.dnr.state.md.us/watersheds/wras/

Additional information on over 130 watersheds in Maryland is available on the Maryland Department of Natural Resources, (MDNR) Internet page Surf Your Watershed at: http://www.dnr.state.md.us/watersheds/surf/index.html

The Maryland Clean Water Action Plan is available at: www.dnr.maryland.gov/cwap/

WATER QUALITY

Maryland's water quality standards address the federal requirements "to restore and maintain the chemical, physical and biological integrity of the Nation's waters" (Clean Water Act, Section 101). Standards have been established to support beneficial uses such as fishing, aquatic life, contact recreation, boating, drinking water supply, and terrestrial wildlife that depend on water. This expanded view of water quality is reflected in current approaches to monitoring, data gathering, and regulation of water bodies as reflected in this watershed characterization.

Designated Uses For Waterbodies

Streams and other water bodies in Maryland are each assigned a "designated use" in the Code of Maryland Regulation (COMAR) 26.08.02.08. An area's designated use refers to a water body's function. The designated uses, such as swimable and fishable, are associated with sets of water quality criteria necessary to support the uses. Together, the designated use and the criteria are commonly referred to as "Water Quality Standards".

In the Port Tobacco River watershed, all bodies of water are categorized under one of two designated uses:

- Use I- Water Contact Recreation and Protection of Nontidal Warmwater Aquatic Life.
- Use II- Support of Estuarine and Marine Aquatic Life and Shellfish Harvesting. This covers the river from Windmill Point to Port Tobacco Marina. The following uses are present in this segment:
    - Migratory Spawning and Nursery Use: February 1 to May 31, inclusive.
    - Shallow Water Submerged Aquatic Vegetation Use: April 1 to October 30, inclusive.
    - Open Water Fish and Shellfish Use: January 1 to December 31, inclusive.

However, waters lying within the confines of any marina and a buffer around the marina are restricted for shellfish harvesting. The size of the buffer depends on the number of slips in the marina (MDE 2002).

Use Impairments

Some streams or other water bodies in the WRAS project area do not meet the full extent of their designated use defined in Maryland regulation. These areas, known as "impaired waters", are tracked by MDE and MDNR under Section 303(d) requirements of the Federal Clean Water Act. The list of impairments for water bodies in the Port Tobacco River watershed for 2004 is summarized below. The non-tidal portion of Port Tobacco River watershed has been listed in 2006 as impaired by bacteria. More information on the 303(d) list can be found at:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/index_new.asp

Nutrients and Suspended Sediments

The Port Tobacco River was included on the 1996 303(d) list for impairment associated with nutrients and suspended sediments from point, nonpoint, and natural sources (Maryland 303(d) list). The Port Tobacco River was identified as being impaired by nutrients due to signs of eutrophication. Eutrophication, the overenrichment of aquatic systems by excessive inputs of nitrogen and phosphorus, was evidenced in the Port Tobacco River by recurrent seasonal algal blooms. Land development as well as the addition of point source discharges can increase the rate of eutrophication to problematic levels. Highly eutrophic waters will characteristically have fewer species present, and

high concentrations of algae. Due to the algae, dissolved oxygen levels are likely to fluctuate between day and night, which can cause fish kills.

Total Maximum Daily Loads

Maryland Department of the Environment uses the 303(d) list of impaired waters to determine the need for establishing Total Maximum Daily Loads (TMDLs). A TMDL is the maximum amount of pollutant that a water body can assimilate and still meet its designated use. A water body may have multiple impairments and multiple TMDLs to address them. MDE is responsible for establishing TMDLs. In general, TMDLs have two key parts:

1- Maximum pollutant load that the water can accept while still allowing the water body to meet its intended use.
2- Allocation of the maximum pollutant load to point and nonpoint pollutant sources.

A document describing TMDLs for the nutrients, nitrogen and phosphorus, for Port Tobacco River was approved by the U.S. Environmental Protection Agency on 3/18/99 (MDE 1999). The water quality goal of these TMDLs is to reduce high chlorophyll a concentrations (a surrogate for algal blooms), and maintain dissolved oxygen standards at levels where the designated uses for the Port Tobacco River will be met.

The low flow TMDL for nitrogen is 8,710 lbs/month, and the low flow TMDL for phosphorus is 871 lbs/month. These TMDLs apply during the period May 1 – October 31. The annual TMDL for nitrogen is 243,310 lb/yr, and the annual TMDL for phosphorus load is 15,570 lb/yr. Allowable loads have been allocated between point and nonpoint sources (http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/tmdl_porttobacco.asp).

A TMDL is required for suspended sediments in the Port Tobacco River but has not been completed.

Water Quality Monitoring

Overview

The lower tidal portion of Port Tobacco River enters the Potomac River near Windmill Point. The tidal waters are oligohaline (0.5-5.0 ppt) in the spring and mesohaline (5.1-18.0 ppt) in the autumn when the freshwater input is lower (MDNR PPSP 1979). Much of the shoreline of the Port Tobacco River's tidal portion is classified as coastal shallow freshwater marsh (MDNR PPSP 1979). Depths of the river range from less than three feet in the headwaters to greater than 30 feet in the tidal zone at the river's confluence with the Potomac River (MDNR PPSP 1979). The upper free-flowing portion of the Port Tobacco traverses a mix of forest, agricultural and developed lands. Tidal waters extend

up to the Route 6 crossing of Port Tobacco Creek and Hoghole Run (Map 2) (MDNR Fisheries, Dividing Lines).

Synoptic Survey

The Synoptic Survey Report, produced by MDE, is a water chemistry analysis (nutrients, temperature, conductivity, pH) on between 30 and 80 sites along stream corridors in the watershed. For the Port Tobacco River watershed Survey, tests for bacteria and optical brighteners were conducted also. Local governments and MDE staff collaboratively choose the sites that MDE will sample. The results of the Survey will be presented in a separate report.

Stream Corridor Assessment (SCA)

The Stream Corridor Assessment (SCA) survey was developed by MDNR's Watershed Restoration Division as a tool to help environmental managers identify environmental problems and prioritize restoration opportunities on a watershed basis. As part of the survey, trained personnel walk the watershed's stream network and record information on a variety of environmental problems that can be easily observed within the stream corridor. Common environmental problems documented in the survey include: eroding stream banks, inadequate stream buffers, exposed pipes, altered stream channels, fish migration barriers, pipe outfalls, in-stream construction sites and trash dumping locations. The results of the SCA will be presented in a separate report with GIS data layers.

MDE Field Operations Program (In-House Water Data)

In August 1984, MDE's Field Operations Program selected four physical parameters, chlorophyll a, inorganic phosphorus, nitrate and dissolved oxygen, to determine the extent of impairment in Port Tobacco River's tidal and non-tidal areas (Map 3: Water Monitoring and Marinas). The survey was conducted in August because conditions can worsen during this period due to less water in the channel, higher concentration of nutrients, and higher water temperatures create good conditions for algal growth. Data collected by MDE's Field Operations Program staff indicated that the nutrient impairments still existed in 1997. In addition, algal blooms were observed annually in Port Tobacco River up through 1998 (MDE 1999). Data from the Environmental Protection Agency's STORET database for 2001 and 2002 suggest a potential improvement in water quality. At the five MDE In-house monitoring sites in the main stem of the Port Tobacco River (Map 3), 79 out of 82 samples had chlorophyll *a* concentrations below the 52µg/l maximum target established in the TMDL document. The MDE In-House Monitoring Data are available on EPA's STORET database: http://www.epa.gov/storet/dbtop.html

Shellfish Certification Division

MDE's Shellfish Certification Division is responsible for regulating shellfish harvesting waters. MDE adheres to the requirements of the National Shellfish Sanitation Program

(NSSP), with oversight by the U.S. Food and Drug Administration. MDE conducts the shoreline surveys and collects routine bacteria water quality samples in the shellfish-growing areas of Maryland. These data are used to determine the status of the shellfish waters. If the water quality criteria are exceeded, the shellfish areas are closed to harvest. Areas that do comply with criteria remain approved or are reclassified as approved. MDE's Shellfish Certification Division has monitored shellfish growing regions throughout Maryland for the past several decades. The waters at the mouth of the Port Tobacco River and in the surrounding waters of the Potomac River are Approved Shellfish Harvesting Areas. The water samples taken near the mouth of Port Tobacco River consistently meet the criterion for shellfish harvesting (MDE Shellfish Certification Division).

MDNR Long-term Monitoring Program

To assist work of the Lower Potomac Tributary Team, MDNR analyzed data from long-term water quality monitoring stations to characterize water quality status and trends. MDNR does not have long term monitoring stations in the Port Tobacco River. However, monitoring stations in the Potomac River mainstem, upstream and downstream of Port Tobacco River, may suggest water quality influences arising from the Potomac River. In the summary table below, the status and trends for each parameter are provided for one upstream station, Maryland Point, and one downstream station, Morgantown Bridge-Route 301.

Status is a measure of current condition (most recent three years) at a station compared either to scientifically based benchmark values or to a benchmark dataset. Based on this comparison, the station is given a ranking of "Good," "Fair," or "Poor." Trends are a measure of how the system has been changing over time, either improving or worsening. More information on the assessment methods is available on the MDNR site:
http://www.dnr.state.md.us/bay/tribstrat/status_trends_methods.html
The information on water quality for the Lower Potomac is available on MDNR's Tributary Strategies site:
http://www.dnr.state.md.us/bay/tribstrat/low_pot/lp_status_trends.html.

Table 1. Status and Trends for Monitoring Sites in the Potomac River Upstream and Downstream of the Port Tobacco River.

Potomac River Parameter	Status (2001-2003)		Trend (1985-2003)	
	Upstream	Downstream	Upstream	Downstream
Nitrogen: Total	Fair	Poor	Improving	Improving
Phosphorus: Total	Fair	Poor	No trend	No trend
Algae: Abundance	Good	Fair	No trend	Degrading
Total Suspended Solids	Good	Fair	No trend	No trend
Water Clarity (Secchi depth)	Good	Poor	No trend	Degrading
Dissolved oxygen (summer, bottom)	Good	Fair	No trend	No trend

Water quality is poorer in the mainstem of the Potomac River downstream of Port Tobacco River but there are other inputs into the Potomac between these two monitoring stations. Nanjemoy Creek on the Maryland side of the Potomac and Choptank Creek on the Virginia side also have outlets to the Potomac in the same area. Therefore, it is unclear how much Port Tobacco River contributes to the degradation of water quality in this section of the Potomac River.

Maryland Biological Stream Survey (MBSS)/Stream Waders

The Maryland Biological Stream Survey, started in 1994, samples non-tidal wadable streams in all of the watersheds in the state on a five year rotation. MBSS samples fish, benthic macroinvertebrates, water chemistry and habitat. An index of biointegrity (IBI) is calculated for fish and benthic macroinvertebrates. The IBI score is a quantitative rating of the health of the fish or benthic macroinvertebrate assemblage found at each site. The survey is based on a probabilistic stream sampling approach where random selections are made from all sections of streams in the state that can physically be sampled. The approach supports statistically-valid population estimation of variables of interest (e.g., largemouth bass densities, miles of streams with degraded physical habitat, etc.) (MDNR MBSS). MBSS data from the first cycle, 1994 - 97, are summarized in basin reports and fact sheets (MDNR MBSS Basin Reports).

MBSS sampled the Port Tobacco River watershed in the 2000-2004 cycle. Out of the 15 sites that were sampled, the fish IBI scores were: good – 20%; fair – 33%; and poor – 47%. The benthic IBI scores were: good – 40%; fair – 33%; and poor – 27% (MDNR MBSS Searchable Database).

In 2000, MBSS started a volunteer program, Stream Waders, to increase the density of samples taken in sub-watersheds of about 8 sq. miles. Stream Waders sample in the same watersheds as the MBSS program but sample only benthic macroinvertebrates. Stream Waders sampled in the Port Tobacco River watershed in 2003 and 2004. Thirty-eight Stream Waders samples were taken in Port Tobacco 2003 and 20 in 2004. In 2003, the water quality ratings were as follows: Good – 5; Fair – 15; Poor – 18. In 2004, the ratings were: Good – 3; Fair – 3; Poor –14. Data from the MBSS and Stream Waders programs can be found at: http://www.dnr.state.md.us/streams/mbss/index.html .

In 2005, MBSS and Stream Waders sampled in the Port Tobacco River watershed. MBSS will present their data in a separate report in 2006 along with all previous MBSS/Stream Waders data for this watershed.

Watershed Organizations

Port Tobacco River Conservancy (PTRC) was formed in 2001 due to concerns about discharges from the area's municipal wastewater treatment facility into tributaries of the Port Tobacco River. With the help of Charles County Commissioners, the Health Department and MDE staff, volunteers from the PTRC have collected water samples at

sites in both tidal and non-tidal waters in the Port Tobacco River watershed since 2003 (Map 3: Water Monitoring and Marinas). The samples were tested for enterococcus bacteria by the Maryland Department of Health and Mental Hygiene. Samples were collected twice a month in 2003 and 2004 then limited to the warm weather months of May through October in 2005 since this is when the highest bacteria levels were found (D. Gardiner, Personal communication). These data were used for the bacteria impairment listing for Port Tobacco River watershed.

Groundwater

Southern Maryland (Charles, Calvert and St. Mary's Counties) has the highest population growth rate in Maryland. Maryland's Department of Planning estimates that by 2020 the area will have a population of nearly 500,000 (the projection for Charles County is 180,000 compared to 120,546 in 2000). Water demand in 2020 will increase by an estimated 20 million gallons per day or more based on a daily per capita usage of 100 gallons and anticipated increases in commercial, institutional, and military pumpage. Although some of this demand may be met from surface-water sources (for example, the Washington Suburban Sanitary Commission), the region will likely remain largely dependant on groundwater into the future (Maryland Geological Survey (MGS) web site; Drummond 2005).

Increased ground-water usage in southern Maryland has caused water levels in the Piney Point, Aquia, and Magothy aquifers to decline. The policy of the Water Rights Division (Maryland Department of the Environment) is to ameliorate the impact of falling water levels on current users, particularly domestic well owners, by directing new water demand to the deeper Patapsco aquifer system. As a result, the Patapsco aquifers (upper and lower) are becoming the primary target for new ground-water appropriators in southern Maryland (MGS web site). The USGS has a monitoring well for the Upper Patapsco aquifer near the mouth of Port Tobacco River. Due to groundwater withdrawal, the level of the well has dropped from 88 feet below the land surface in 1962 to 126 feet below in 1999 (USGS web site). The deeper Patuxent aquifer could be evaluated as an alternative water supply for Charles County (Drummond 2005).

Point Sources

Discharges from pipes or other "discrete conveyances" are called "point sources." Point sources may contribute pollution to surface water or to groundwater. For example, wastewater treatment discharges may contribute nutrients that reduce oxygen available for aquatic life. Stormwater discharges may contribute excessive flow of water and/or seasonally high temperatures. Industrial point sources may contribute other forms of pollution. Some understanding of point source discharges in a watershed targeted for restoration is useful in helping to prioritize potential restoration projects.

Many types of point sources operate under permits issued by the Maryland Department of the Environment (MDE). A search of the National Pollution Discharge Elimination System (NPDES) Permitted Sites indicates that there is one major point source discharge

in the Port Tobacco River watershed from the La Plata waste water treatment plant (Map 4: Point Sources and Table 2). There are also a number of minor municipal, industrial groundwater and general permitted discharges. Storm sewer outfalls of 36" in diameter and greater, located in the County's Development District, are shown on Map 5: County Data.

Marinas

Discharges of sewage from boats are a concern for water quality because they release nutrients, biochemical oxygen demand and pathogens. These discharges are preventable if a sufficient number of pumpout facilities are locally available and boat operators take advantage of these services. Boat maintenance and operation also can contribute petroleum and other noxious materials to the aquatic environment. Port Tobacco River has two marinas both of which have pumpout stations. (Map 3: Water Monitoring and Marinas).

Fish Blockages

Many fish species migrate between the marine environment and freshwater to complete their life cycles. Anadromous fish, such as American shad, hickory shad and alewife herring, spawn and hatch from eggs in free flowing streams but live most of their lives in estuarine or ocean waters. Catadromous fish, like the American eel, reproduce in the Ocean and mature in estuaries or freshwater. Blockages in streams can inhibit or prevent these fish species from reaching habitats needed for breeding or development. Dams, culverts, and exposed sewer pipes can become barriers to fish migration. MDNR's Fish Passage Program maintains a database of fish blockages and works to eliminate them or provide passage over the barrier. The Fish Passage Program has completed 61 projects, reopening a total of 349 miles of upstream spawning habitat throughout the State (MDNR Fisheries, Fish Passage web site). No major fish blockages are listed in the Fish Passage Program's database for Port Tobacco River watershed. However, the Stream Corridor Assessment will identify potential migration barriers and prioritize them for removal or mitigation.

Table 2. Port Tobacco River MDE Permits.

Major Municipal Surface Discharge (Sewage Treatment)				
Permit No.	NPDES No.	Facility Name	Address	City
04DP0518	MD0020524	LA PLATA WWTP	CURLEY HALL ROAD, OFF ROUTE 6	LA PLATA

Municipal Surface Discharge (Sewage Treatment)				
Permit No.	NPDES No.	Facility Name	Address	City
00DP1107	MD0052311	COLLEGE OF SOUTHERN MARYLAND	8730 MITCHELL ROAD	LA PLATA
05DP3500	MD0069442	CHAPEL POINT WOODS WTP	SPICEWOOD RUN & SOLDIERWOOD COURT	BEL ALTON
03DP1246	MD0053228	MOUNT CARMEL WOODS WWTP	9235 MITCHELL ROAD	LA PLATA
94DP2088	MD0060411	PORT TOBACCO MARINA WWTP	7610 SHIRLEY BOULEVARD	PORT TOBACCO

Industrial Surface Discharge				
Permit No.	NPDES No.	Facility Name	Address	City
03DP3443	MD0069108	SHA - LA PLATA MAINTENANCE FACILITY	5725 WASHINGTON AVENUE	LA PLATA

Industrial Groundwater Discharge				
Permit No.	NPDES No.	Facility Name	Address	City
05DP3507		LA PLATA VOLUNTEER FIRE DEPARTMENT	911 WASHINGTON AVENUE	LA PLATA
06DP3530		SOUTHERNS CARS	4610 CRAIN HIGHWAY	WHITE PLAINS

General Industrial Stormwater				
Permit No.	NPDES No.	Facility Name	Address	City
TBA		GOOSE BAY MARINA, INC.	9365 GOOSE BAY LANE	WELCOME
02SW1636		LA PLATA WWTP	CURLEY HALL ROAD, OFF ROUTE 6	LA PLATA
02SW1671		RELIABLE CONTRACTING COMPANY - WHITE PLAINS	10315 THEODORE GREEN BOULEVARD	WHITE PLAINS
02SW1333		SHA - LA PLATA MAINTENANCE FACILITY	5725 WASHINGTON AVENUE	LA PLATA
02SW1220		WASTE MANAGEMENT OF MARYLAND - SOUTHERN MARYLAND	THEODORE GREEN BLVD.	WHITE PLAINS

General Permits				
Permit No.	NPDES No.	Facility Name	Address	City
01SI6016	MDG766016	BEST WESTERN LA PLATA INN	6900 CRAIN HIGHWAY	LA PLATA
01SI6067	MDG766067	DORCHESTER NEIGHBORHOOD ASSOCIATION POOL	5005 DORCHESTER CIRCLE	WALDORF
02MA9161		GOOSE BAY MARINA, INC.	9365 GOOSE BAY LANE	WELCOME
01SI6902	MDG766902	MCDONOUGH HIGH SCHOOL	7165 MARSHALL CORNER ROAD	POMFRET
01SI6011	MDG766011	THUNDERBIRD APARTMENTS / BEL ALTON MOTEL WWTP	TWINBERRY DRIVE	BEL ALTON
00MM9760	MDG499760	WILLETT PIT II - MOORE PROPERTY	10300 BLOCK OF BILLINGSLEY ROAD	WHITE PLAINS

LIVING RESOURCES AND HABITAT

Living resources, including all the animals, plants and other organisms require water to survive. They and their habitats are intimately connected to water quality and availability. Living resources respond to changes in water and habitat conditions in ways that help us interpret the status of water bodies and the effects of watershed conditions. In some cases, water quality is measured in terms of its ability to support specific living resources like trout or shellfish. Information on living resources is presented here to provide a gauge of water quality and habitat conditions in the watershed. It is also a potential measure of efforts to manage water quality and watersheds for the living resources that depend on them.

In this document, we will provide an overview of the status of living resources in the Port Tobacco River watershed. Current assessments of the biological condition of the non-tidal streams will be provided by MDNR's Maryland Biological Stream Survey in a separate report.

A list of rare, threatened and endangered (RTE) species for Port Tobacco River watershed can be found in Appendix A (MDNR Natural Heritage Program). No fish or benthic macroinvertebrates appear on the list. In addition, MDNR's Natural Heritage Program has a list of Rare, threatened and endangered species sorted by county: http://www.dnr.state.md.us/wildlife/espaa.asp

Fish

Watershed Indicators

MDNR has developed rating scales for a number of watershed indicators (MDNR Watershed Indicators web site). The Migratory Fish Spawning Areas indicator was developed using MDNR Fisheries Service information and Habitat Requirements for Chesapeake Bay Living Resources. Port Tobacco River Watershed has a rating of four out of seven (seven being the best) for migratory fish spawning habitat. The Imperiled Aquatic Species Indicator is scored from 0 – 10 (10 is best), based on the number of sites with rare species, their status (rare, threatened or endangered), and the diversity of aquatic animals. The rating for Port Tobacco River watershed is six (MDNR Watershed Indicators web site).

Fisheries

Many anglers enjoy tidal fishing for largemouth bass. The Potomac River from DC down to Port Tobacco River is one of the most popular areas. This stretch is ranked annually in the top 5 of best bass fishing places in the United States, and in 2005 was ranked #1 in Field and Stream magazine (MDNR Fisheries, Recreational Fisheries).

For freshwater recreational fishing, the following species are found in the Potomac and its tributaries: largemouth bass, striped bass, chain pickerel, crappie, channel catfish,

yellow and white perch, bluegill sunfish and carp (MDNR Fisheries). Fish Consumption Advisories by species for the entire State can be found at: http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/home/index.asp Several species have consumption advisories for the Potomac River from the DC border down to Rt. 301 in Maryland (downstream of the confluence with the Port Tobacco River). These species include: American eel, Channel catfish, Common carp, Small and Largemouth bass, White catfish, and White perch. In addition, small and largemouth bass have advisories for all rivers and streams Statewide (MDE Fish Consumption Advisories).

Striped Bass Seine Survey

MDNR Fisheries conducts an annual juvenile striped bass seine survey to assess the year-class success for young-of-the-year striped bass and many of fish species. Over 100 fish species have been collected since 1954. Annual indices of relative abundance provide an early indicator of future adult stock recruitment. There are 22 fixed sampling sites around the Chesapeake Bay. Although there are no sites in the Port Tobacco River, there are sites in the Potomac River upstream and downstream from the Port Tobacco River. Data listed by species for the Chesapeake Bay and major tributaries can be found at: http://www.dnr.state.md.us/fisheries/juvindex/

Coastal Conservation Association (CCA)/PTRC Yellow Perch Spawning Survey

Yellow perch (*Perca flavescens*) were once abundant in the Port Tobacco River. The Environmental Atlas of the Potomac Estuary (MDNR, Power Plant Siting Program, 1979) describes the upper reaches of the Port Tobacco River as "Major spawning areas" and the tidal portion as "Primary nursery areas" based on 1974 data. Since then, the population of yellow perch in the Port Tobacco River has dropped dramatically (MDNR Fisheries, Yellow Perch Fact Sheet and MDNR Fisheries, Yellow Perch Status Report).

> "Yellow perch populations in Chesapeake Bay are generally stable or increasing, although the river specific nature of yellow perch stocks makes determining stock status difficult. Systems in the upper Bay still have substantial populations and spawning runs. However, tributaries in the middle and lower Bay are experiencing depressed populations, with little or no spawning runs. Historically, these systems had large populations of yellow perch. Environmental factors including increased sedimentation from improper land use, decreased spawning habitat caused by stream blockages, and the interaction of metals and acid rain, may be to blame for these declines and may also adversely affect the reproductive success of these stocks.", MDNR Fisheries, Yellow Perch Fact Sheet.

In 2003-2005, the PTRC and CCA conducted yellow perch spawning and seining surveys and found a steady increase in the number of egg masses. In 2003, they found no egg mass and few fish; in 2004, 10 egg masses were found; and in 2005, 112 egg masses were found (D. Gardiner, Personal communication).

Benthic Macroinvertebrates

The Benthic Index of Biotic Integrity (BIBI) was developed to assess the stream macroinvertebrate community. For the benthic IBI, reference conditions were established for minimally-impacted streams. IBI values used in this assessment are relative to conditions in these minimally-impacted streams. For purposes of the Clean Water Action Plan's Unified Watershed Assessment, an original 1 to 5 scale was expanded to a scale of 1 to 10 (1 most degraded, 10 best condition) (MDNR Watershed Indicators). The benthic IBI for Port Tobacco River Watershed is 4.6 indicating a poor benthic community (MDNR Watershed Profiles, Port Tobacco River). Current information on the status of the benthic macroinvertebrate communities will be provided by MDNR's MBSS survey in a separate report.

Sensitive Species

Sensitive species are generally recognized as being the plants or animals that are most at risk in regards to their ability to maintain healthy population levels. Perhaps the most widely known are the State and Federally-listed Endangered or Threatened animals such as the bald eagle and Delmarva fox squirrel. In addition to animals such as these however, both the United States Fish and Wildlife Service and the MDNR work through their respective Federal and State programs to protect a wide variety of declining non-game animals, rare plants, and the unique natural communities that support them. For the purposes of watershed restoration, it is important to account for the known or potential habitat for sensitive species. Protecting or expanding these habitats helps to conserve biodiversity and is an effective component of a watershed restoration program.

MDNR's Wildlife and Heritage Service identifies important areas for sensitive species conservation in different ways. Several sensitive species overlays are used by the State of Maryland to delineate habitat associated with these species. One overlay is the Sensitive Species Project Review areas which are buffered areas enclosing ecologically significant areas (areas that harbor or could potentially harbor rare, threatened or endangered species). Map 6, Sensitive Species, shows the general locations of sensitive species conservation areas in the Port Tobacco River watershed.

There are broadly applied State and Federal laws and regulations that address "takings" of listed species. In addition, many counties have incorporated safeguards for areas associated with sensitive species into their project and permit review processes as well as adopting specific ordinances in some cases to protect them. In all instances, property owners are encouraged to seek advice on protecting the sensitive species/habitat within their ownership. Property owners and other citizens can help protect sensitive species by obtaining advisement from the MDNR Natural Heritage Program.

Maryland Department of Natural Resources' Natural Heritage Program has provided a list of Rare, threatened and endangered (RTE) species for the Port Tobacco River watershed that can be found in Appendix A. In addition, a list of RTE for each county is available at: http://www.dnr.state.md.us/wildlife/espaa.asp

Chesapeake Bay Critical Area Act

The Chesapeake Bay Critical Area Act, passed in 1984, designated as "Critical Areas" all lands within 1,000 feet of tidal waters or adjacent tidal wetlands (MDNR Critical Areas). The lands contained within this area are subject to development guidelines that attempt to minimize the impacts of development and to preserve valuable natural resources. The local jurisdiction has the duty to enforce its local regulations in these areas but the law also created a statewide Critical Area Commission to oversee the development and implementation of local land use programs in the Critical Areas. Map 6, Sensitive Species, shows the Critical Areas within the Port Tobacco River watershed. More information on Critical Areas can be found at: http://www.dnr.state.md.us/criticalarea/

Submerged Aquatic Vegetation

The well-defined link between water quality and submerged aquatic vegetation (SAV) distribution/abundance make SAV communities good barometers of the health of estuarine ecosystems. SAV is important as an indicator of water quality, provides food for many species and it is a critical nursery habitat for many estuarine species (MDNR Bay Grasses).

Map 7, Submerged Aquatic Vegetation, shows SAV acreage in the Port Tobacco River from 1987 to 2003. For clarity, data from 1992 and 2002 have been omitted from the map. In 1987, 1992, and 1997 there were 274 acres, 189 acres and 231 acres of SAV, respectively. However, in 2002 coverage dropped to 7 acres. 2001 and 2002 were drought years causing low flow and reduced run-off. In some tributaries, this caused an increase in salinity and a decline in SAV. This might have contributed to the drop in acreage in 2002 in the Port Tobacco River. Although in some parts of the Bay the drought years led to improved water clarity and an increase in SAV. In 2003, Hurricane Isabel took a toll on the SAV all across the Bay and coverage in the Port Tobacco River remained low at 31 acres (MDNR news release 2003).

LANDSCAPE

Land Use

The Port Tobacco River is approximately 8.5 miles in length with a watershed of approximately 28,000 acres or 44 square miles (MDP 2002). The predominant land use in the watershed, based on 2002 data from Maryland Department of Planning (Map 8: Land Use/Land Cover), is forest and brush (15,763 acres or 56%), with other areas covered by agricultural land (5,671 acres or 20%), developed land (6,351 acres or 23%), wetlands (226 acres or 1%) and bare ground (52 acres or <1%). Most of the developed land is in the non-tidal portion of the watershed, particularly in the northern and eastern sections of the watershed. The non-tidal water quality data maps will be in a separate document, so a connection between land use and water quality for this watershed cannot be presented

here. Agricultural land is often a major contributor of nutrients to the streams, urban areas also contribute nutrients but generally present more of a problem with physical degradation of non-tidal streams due to storm water runoff.

Table 3: Maryland Land Use Distribution for Port Tobacco River Watershed. (MDP data 2002)

Land Use Description	Area (Acres)	Percent of Total
Forest/Brush	15,763	56
Agriculture	5,671	20
Wetlands	226	1
Barren Land	52	<1
Developed Land	6,351	23
Total land area	28,064	100

Protected Lands

As used in the context of watershed protection and restoration, "protected land" includes any land with some form of long-term limitation on conversion to urban/developed land use. This protection may be in various forms: public ownership for natural resource or low impact recreational intent, private ownership where a third party acquired the development rights or otherwise acquired the right to limit use through the purchase of an easement, etc. The extent of "protection" varies greatly from one circumstance to the next. Therefore, for some protected land, it may be necessary to explore the details of land protection parcel-by-parcel through the local land records office to determine the true extent of protection.

For purposes of watershed management, an understanding of existing protected lands can provide a starting point in prioritizing potential protection and restoration activities. In some cases, protected lands may provide opportunities for restoration projects because owners of these lands may value natural resource protection or enhancement goals. More information on watershed protection can be found in: *The Practice of Watershed Protection* (Schueler and Holland 2000).

Map 9, Protected Lands, shows the status of protected lands in the Port Tobacco River Watershed. Some land parcels may be affected by more than one type of protection. For example, government-owned parkland may also have a conservation easement on it. Federal lands make up 390 acres and state parks cover 843 acres with total park lands covering 1,233 acres or 4% of the watershed. Forest conservation easements comprise 374 acres and other conservation easements cover 1,191 acres making up 1,566 acres of easements (6%). In addition, the watershed includes 2, 384 acres (8%) of Resource Protection Zone in which no construction other than utilities and road crossing is permitted. Therefore, 18% of the watershed is under some form of protection.

Soils

Soil type and moisture conditions greatly affect how land may be used and the potential for vegetation and habitat on the land. Soil conditions are also one determining factor for water quality in streams and rivers. Soils are an important factor to incorporate in targeting projects aimed at improving water quality or habitat.

Local soil conditions vary greatly from site to site. Soils data were provided by the United States Department of Agriculture and Maryland Department of Natural Resources. A summary of this information is shown for the WRAS watershed in Map 10, Soils Important for Watershed Planning.

- Overall, about 3,036 acres (10%) of the watershed is prime agricultural soil that does not require drainage or irrigation. Another 124 acres (<1%), requiring either drainage or irrigation, is also potentially prime agricultural soil.

- Nearly 5,229 acres exhibit hydric characteristics. Hydric soils adjacent to streams or wetlands may offer opportunities for restoration of natural vegetated buffers or wetlands that could intercept nitrogen moving in groundwater before it reaches surface waters.

Green Infrastructure

The MDNR has mapped a Statewide network of ecologically important lands across the State called “Green Infrastructure”. This network is comprised of large blocks of important natural resource lands called hubs and corridors that connect the hubs. These areas are primarily large blocks of contiguous forest but also include wetlands and other naturally vegetated lands. These lands provide significant environmental benefits, such as cleaning the air, filtering and cooling water, and storing and cycling nutrients. Appendix B provides a detailed assessment of the Green Infrastructure in the Port Tobacco River watershed.

Large Forest Blocks

Forest interior dwelling species (FIDS) require large blocks of forest habitat with relatively little influence from open-areas species or from humans. FIDS habitat is a forest block at least 50 acres in size with at least 10 acres of forest interior (forest edge is at least 300 feet away). High quality FIDS habitat is either mature hardwood or mixed hardwood-pine forest at least 100 acres in size of which forest interior habitat comprises at least 25% of the total forest area. This habitat also must contain one or more of the following:

- Contiguous forest acreage of greater than 50 acres;
- Riparian forest bordering a perennial stream or river and, on average, at least 300 feet in width;

- At least one highly area-sensitive species or Black-and-white Warbler, as a probable or confirmed breeder;
- Mature river terrace, ravine, or cove hardwoods, located at least 300 feet from the nearest forest edge;
- At least 5 contiguous acres of old growth forest (as defined in the 1989 MD Department of Natural Resources report "Old Growth Forest Ecosystems") located at least 300 feet from the nearest forest edge (MDNR Forest Service 2003).

The forest interior assessment map differs from the Green Infrastructure assessment in that forest interior areas are more numerous and more widely distributed because the forest interior size threshold is lower (MDNR web site). Map 11, Large Block Forest Habitat, shows that the Port Tobacco watershed contains 11,298 acres of high quality FIDS habitat which makes up 72% of the total forest area. Other FIDS habitat occupies 1,165 acres (7%) and other forest land comprises 3,300 acres (21%) (MDNR, Natural Heritage Program and MDP 2002).

Wetlands

The U.S. Army Corps of Engineers and the U.S. Environmental Protection Agency define wetlands as follows (EPA Office of Wetlands, Oceans and Watersheds web site):

"Wetlands are areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas."

The Coastal Plain Province likely has the highest diversity of emergent estuarine and palustrine (fresh water) wetland communities relative to other Maryland physiographic regions because the area has both tidal and nontidal freshwater marshes. Wetlands are most abundant in the Coastal Plain due to the low topographic relief and high ground water table characteristic of the region.

Wetland Functions

The State of Maryland Nontidal Wetlands Protection Act of 1989 designates statutory wetland functions which are summarized in Table 4 (MDE Wetlands web site; Tiner and Burke 1995).

Wetland Categories

Estuarine wetlands are abundant throughout the Coastal Plain. These systems consist of salt and brackish tidal waters and contiguous wetlands where ocean water is at least occasionally diluted by freshwater runoff from the land. These wetlands may extend far upstream in tidal rivers to freshwater areas. Differences in salinity and tidal flooding within estuaries have a significant effect on the distribution of these wetland systems. Salt

marshes occur on the intertidal shores of tidal waters in areas of high salinity. Brackish marshes are the predominant estuarine wetland type in Maryland. They are found along the shores of Chesapeake Bay, mostly on the Eastern Shore, and for considerable distance upstream in coastal rivers. Estuarine shrub swamps are common along the Maryland coastal zone. Aquatic beds, comprised mostly of submerged aquatic vegetation (SAV), were historically abundant in shallow water zones of Maryland's estuaries, especially Chesapeake Bay and its tributaries.

Table 4. Wetland Functions.

Function	Definition
Ground Water Recharge and Discharge	The capacity of processes in a wetland to influence the amount of water and the rate at which it moves between the ground water system and the surface water system
Stormwater and Flood Control	The capacity of a wetland to store large volumes of water during floods; wetlands modify the flow in streams by decreasing peak discharge (volume of water over a given time) and increasing time of concentration (time between rainfall/flood event and release of water to streams)
Improved Water Quality Toxic Retention Nutrient Removal Transformation	Removal of suspended and dissolved solids and nutrients from surface and ground water and conversion into other forms, such as plant and animal biomass or gases
Sediment Stabilization and Retention	The capacity of processes in a wetland to cause the deposition and retention of inorganic and organic sediments from the water column, primarily through physical processes
Aquatic Diversity and Habitat	The capacity of a wetland to produce an abundance and diversity of hydrophytic plant species and communities, and aquatic habitats for animals
Wildlife Diversity and Habitat	The capacity of a wetland to produce large and/or diverse populations of animal species and communities that spend part or all of their life cycle in wetlands

Palustrine wetlands are freshwater wetlands that are not associated with flowing water or lakes. In general, palustrine wetlands are associated with freshwater, high water tables, intermittent ponding on land or flood plains. Forested wetlands are the most abundant and widely distributed palustrine wetland type on the Coastal Plain. These wetlands are found on floodplains along the freshwater tidal and nontidal portions of rivers and streams, in upland depressions, and in broad flat areas between otherwise distinct watersheds. Tidal freshwater swamps occur along coastal rivers in areas subject to tidal influence. Emergent wetlands on the Coastal Plain are characterized by a wide range of vegetation, depending on water regime. (Adapted from Wetlands of Maryland, Tiner and Burke, 1995.)

Based on the MDNR wetland GIS data, wetland acreage in the Port Tobacco River, not including open water, is shown on Map 12, Wetlands and Floodplains. Data were provided by MDNR, the Federal Emergency Management Agency and the U.S. Fish and Wildlife Service. Data are summarized in the table below.

Table 5. Wetland Types in Port Tobacco River Watershed.
(Published: 1993)

Type of Wetland	Acreage	Percent
Estuarine, Emergent	226	13
Estuarine, Scrub/Shrub	4	<1
Total Estuarine	230	13
Aquatic Bed	2	<1
Palustrine, Emergent	97	6
Palustrine, Forested	1,179	68
Palustrine, Scrub/Shrub	131	7
Palustrine, Unconsolidated bottom	77	4
Unconsolidated shore	4	<1
Farmed	13	<1
Total Palustrine	1503	87
Total for watershed	1,733	100

Tracking Wetlands

Oversight of activities affecting wetlands involves several regulatory jurisdictions. The Maryland Department of the Environment (MDE) is the lead agency for the State and cooperates with MDNR, the Army Corps of Engineers and other Federal and local agencies. MDE tracks State permitting of permanent impacts on wetlands and mitigation projects. Based on the permit data, Port Tobacco River watershed has had a net gain (14 acres) of nontidal wetlands for the period from 1991 to 2005 (Walbeck 2005).

Nontidal Wetlands of Special State Concern

Non-tidal wetlands containing rare, threatened, endangered species or unique habitat are identified as Non-tidal Wetlands of Special State Concern (WSSC) in MDE regulations. There are four small State-designated non-tidal WSSCs in Port Tobacco River watershed: Brentland Woods; Cat Pond; Port Tobacco Run; and Thomas Stone National Historic Site. None of these sites are protected (MDE 2006). Map 6, Sensitive Species, shows these wetlands making up a total of 35 acres.

Floodplains

Floodplains, particularly those that contain hydric soils, tend to present conditions that limit intensive use. These conditions also present opportunities for maintenance or restoration of natural vegetation, habitat and water quality. Targeting of water quality-

related projects, like stream buffers, or habitat-related projects like Green Infrastructure enhancement, should consider local floodplain conditions. Map 12, Wetland and Floodplains, shows that the 100-year flood plain extends nearly the entire length of the Port Tobacco River and covers 1,805 acres.

Shoreline and Sea Level Rise

Natural shoreline provides important habitat for fish, shellfish, horseshoe crabs, and birds. Structural shoreline stabilization practices, such as bulkheads and riprap, prevent encroachment from sea level rise that would have resulted in new tidal wetlands (MDE 2006). The average rate of sea level rise along Maryland's coastline has been 3-4 mm/yr, or approximately one foot per century. Such rates are nearly twice those of the global average (1.8 mm/year), a result probably due to substantial land subsidence (Johnson 2000).

Stream Buffers

Benefits of Stream Buffers

Natural vegetation in stream riparian zones, particularly forest, provides numerous valuable environmental benefits:

- Reducing surface runoff;
- Preventing erosion and sediment movement;
- Using nutrients for vegetative growth and moderating nutrient entry into the stream;
- Moderating temperature, particularly reducing warm season water temperature;
- Providing organic material (decomposing leaves) that are the foundation of natural food webs in stream systems;
- Providing overhead and in-stream cover and habitat;
- Promoting high quality aquatic habitat and diverse populations of aquatic species.

Land Use Adjacent to Streams

Map 13, Land Use/Land Cover at Stream's Edge, shows the general land use adjacent to streams in Port Tobacco River watershed using computerized GIS. Data were provided by Maryland Department of Planning and Maryland Department of Natural Resources. This method of assessing buffer condition can be used in the absence of field data collected by the Stream Corridor Assessment. Port Tobacco River has 157 miles of perennial, flowing streams at the 1/24,000 scale with 97 miles of stream buffer covered by forest, wetlands and brush. Agricultural land covers 32 miles of the land adjacent to the streams and development covers 28 miles.

RESTORATION TARGETING TOOLS

Stream Corridor Assessment

Using the Stream Corridor Assessment, valuable information can be compiled to assist in targeting restoration activities. This information will complement existing watershed-related information and may explain cause and effect relationships between what is occurring in the watershed and how those activities are impacting the stream systems. Trained teams walk along streams to identify and document potential problems and restoration opportunities such as pipe outfalls, fish blockages, pond sites, and exposed pipes. MDE will provide a report for County use.

Synoptic Survey and MBSS

Based on Synoptic Survey sampling in the Port Tobacco River watershed, MDE staff reported on water quality in nontidal streams to supplement knowledge of local conditions. Based on selected parameters (dissolved oxygen, nitrogen, phosphorus, pH, conductivity, temperature, optical brighteners and bacteria), the survey findings will help identify problem areas and relative conditions among local streams. It will also help rank subwatersheds by their nutrient load contributions to the waterbodies. For the same 2005 sampling sites, the MBSS survey results describe the benthic organism populations in nontidal streams as a gauge of water quality and habitat conditions. MDNR's report of 2005 findings will include assessment of water quality, benthic organism populations and the potential relationships that may be drawn from the data.

Agricultural Conservation Programs

The Charles County Soil Conservation District works with farmers and landowners in the development of Soil Conservation and Water Quality plans that recommend best management practices that will prevent nutrient and sediment impact on surface and ground water. Some of the conservation practices that can be used are grassed waterways, riparian herbaceous and riparian forested buffers, conservation cover, cover crops, shallow water wildlife areas and grade stabilization structures. The Maryland Agricultural Cost-Share program (MACS), the Conservation Reserve Program (CRP and CREP) and the Environmental Quality Incentive Program (EQIP) are some of the state and federal programs promoted and administered by the Soil Conservation District. Farmers in the watershed who are already using good management practices that benefit water quality could provide examples to promote adoption of similar practices by other farmers.

Fish Blockage Removal

Many fish species need to move from one stream segment to the next in order to maintain healthy resilient populations. Blockages in streams can inhibit or prevent many fish species from moving up stream to otherwise viable habitat. To help prioritize stream

blockages for mitigation or removal, the MDNR Fish Passage Program maintains a database of significant blockages to fish movement. The listings in this database should be considered as supporting information for initiating a thorough Stream Corridor Assessment. Based on experience in other watersheds, it is likely that the assessment will identify additional potential fish blockage problems. Some blockages to fish movement may be structural components of stream gauging weirs, farm ponds, drainage ditches, etc. If a blockage is found to be in this category, circumstances like requirements for drainage control function and public or landowner needs are considered in determining the potential for a restoration project.

Stream Buffer Restoration

Natural vegetation in stream riparian zones act as stream buffers that can provide numerous valuable environmental benefits such as reducing surface runoff, preventing erosion, and providing overhead cover and habitat.

Headwater Streams

Headwater streams are the smallest and most numerous in Maryland watersheds and, unlike larger streams, they intercept all of the surface runoff within the watersheds that they drain. Also, these streams at the "top" of the watershed are the type and size that are most effected by development. In addition, for many watersheds, headwater streams drain the majority of the land within the entire watershed; therefore, stream buffers restored along headwater streams tend to have greater potential to intercept nutrients and sediments than stream buffers placed elsewhere. The nutrient removal function of headwater streams buffers with their associated springheads provides water supply benefits. In targeting stream buffer restoration projects, giving higher priority to headwater streams is one approach to optimizing nutrient and sediment retention. Restoring headwater stream buffers can also provide habitat benefits that can extend downstream of the project area. Forested headwater streams provide important organic material, like decomposing leaves, which “feed” the stream’s food web. They also introduce woody debris that enhances in-stream physical habitat. The potential for riparian forest buffers to significantly influence stream temperature is greatest in headwater regions. These factors, in addition to positive water quality effects, are key to improving aquatic habitat.

Optimizing Water Quality Benefits by Combining Priorities

Strategic targeting of stream buffer restoration projects may promote many different potential benefits. To maximize multiple benefits, site selection and project design need to incorporate numerous factors. For example, finding a site with a mix of attributes like those in the following list could result in the greatest control of non-point source pollution and enhancement to living resources:

– land owner willingness / incentives,
– marginal land use in the riparian zone,

– headwater stream,
– hydric soils,
– selecting appropriate woody/grass species,
– adjacent to existing wetlands / habitat.

Additionally, selecting restoration projects that are likely to produce measurable success is an important consideration in prioritizing projects for implementation. In the early stages of a watershed restoration program, measurable water quality improvement can be one of the strongest ways to demonstrate project success. In general, targeting restoration projects to one or a few selected tributaries or small watersheds will tend to offer the greatest probability of producing measurable water quality improvement.

Wetland Restoration

Wetlands serve important environmental functions such as erosion control, habitat and nursery areas for many organisms and nutrient uptake/recycling. However, most watersheds in Maryland have significantly fewer wetland acres today than in the past. This loss due to draining, filling, etc. has led to habitat loss and negative water quality impacts in streams and in the Chesapeake Bay. Reversing this historic trend is an important goal of wetland restoration. Staff from MDE's Waterways and Wetlands Program and WRAS can provide assistance to local governments in targeting wetland restoration efforts.

POTENTIAL BENCHMARKS FOR WRAS GOAL SETTING

Several programs designed to manage water quality and/or living resources have existing or proposed goals that are relevant to setting goals for the Port Tobacco River Watershed Restoration Action Strategy (WRAS). The goals from these other programs tend to overlap and run parallel to potential interests for developing WRAS goals. Therefore, to assist in WRAS development, selected goals from other programs are included here as points of reference.

Water Quality Standards and TMDLs

Water quality standards represent minimum legal goals for managing the physical, chemical and biological integrity of the Nation's waters. Achieving these standards will necessitate the restoration and protection of habitat and living resources within the watershed.

In order to meet water quality standards, Total Maximum Daily Loads (TMDLs) have been established for pollutants in many impaired waterbodies. TMDLs represent pollutant loading goals. In watershed management plans designed to implement TMDL goals, Best Management Practices (BMPs) are often included. BMPs are management practices (such as nutrient management) or structural practices (such as terraces) designed to reduce the quantities of pollutants. Thus, water quality standards, TMDLs,

and BMPs reflected in implementation plans provide a set of benchmarks, which are linked together via a systematic water quality management framework.

Existing water quality impairments, water quality goals, and loading goals for the Port Tobacco River are documented in the TMDL(s) for that waterbody. Watershed plans should focus on implementation actions that have a high likelihood of improving these specific water quality impairments.

Chesapeake 2000 Agreement

The Chesapeake 2000 Agreement (C2K) includes several significant commitments pertaining to local watershed management planning and implementation. These are the load reduction goals for nitrogen and phosphorus, and the watershed management planning goal.

The C2K Agreement called for the refinement of water quality standards in the Bay, and the assignment of nutrient load reductions to each major tributary. The Agreement also called for the revision of Tributary Strategy implementation plans to "achieve and maintain the assigned loading goals." This process is analogous to the process by which TMDLs have been established at a more refined geographic scale. Thus, watershed management plans that strive for either goal are ensured to complement the other.

The goal in the C2K Agreement that is directly related to the development of watershed management plans and action strategies is:

> "By 2010, work with local governments, community watershed groups and watershed organizations to develop and implement locally supported watershed management plans in two-thirds of the Bay watershed covered by this Agreement. These plans would address the protection, conservation and restoration of stream corridors, riparian buffers and wetlands for the purposes of improving habitat and water quality, with the collateral benefits for optimizing flow and water supply (Chesapeake 2000 Agreement)."

Four common elements of watershed management planning were adopted by the Chesapeake Bay Program member jurisdictions to be applied Bay-wide. Those elements support the WRAS components that were also identified as common Bay-wide criteria for watershed management planning. The four approved C2K Agreement watershed-planning elements are as follows:

1. Does the plan "address the protection, conservation and restoration of stream corridors, riparian forest buffers and wetlands?" Each watershed management plan needs to be based on site-specific assessments of natural resources within the watershed. At a minimum, the assessment will evaluate the condition of stream corridors, riparian buffers and wetlands within the watershed.

2. Does the plan reflect the goals and objectives of "improving habitat and water quality?" The plan should reflect the issues that the stakeholders feel are important, and, at a minimum, exhibit a benefit to habitat and water quality within the watershed. The goals should be based on priority issues identified by the watershed assessment.

3. Chesapeake 2000 Watershed Commitments (CWiC) Criteria #3-- Does the plan identify implementation mechanisms? Capacity to implement the plan will be demonstrated by identifying:

- What are the specific management actions?
- What are the resources necessary for implementation?
- Who will implement the plan?
- When will the actions be implemented?

4. Does the plan have demonstrated local support? Every effort should be made to demonstrate a diversity of local support. At a minimum, local governments, community groups and watershed organizations should be encouraged to participate in developing and implementing the watershed management plan.

Water Quality Improvement Act of 1998

The Water Quality Improvement Act of 1998 presents many challenges for agriculture in Maryland. It represents a major change in our approach to controlling agricultural nutrient pollution. The Act requires nutrient management plans for both nitrogen and phosphorus for virtually all Maryland farms. The Maryland Agricultural Water Quality Cost-Share (MACS) Program offers cost-share assistance for the development of nutrient management plans. The Manure Transport Program helps poultry, dairy, beef and other livestock producers cover the costs of transporting excess manure identified by their nutrient management plans off their farms. Implementation of projects assisted by this funding has the potential to move nutrients to sites where they are needed and reduce nutrient input to Maryland's waters (University of Maryland 1998; Maryland Department of Agriculture 2003).

REFERENCES

Charles County:
http://www.charlescounty.org/pgm/planning/census/default.htm

Chesapeake 2000 Agreement:
http://www.chesapeakebay.net/agreement.htm

Drummond, David D. 2005. *Water-Supply Potential of the Coastal Plain Aquifers in Calvert, Charles and St. Mary's Counties, Maryland, with Emphasis on the Upper Patapsco and Lower Patapsco Aquifers.* Maryland Geological Survey, Maryland Department of Natural Resources.

Environmental Protection Agency (EPA) Office of Wetlands, Oceans and Watersheds:
http://www.epa.gov/owow/wetlands/facts/fact11.html

Gardiner, David. Personal communication. Port Tobacco River Conservancy.

Interstate Commission on the Potomac River Basin (ICPRB):
http://www.potomacriver.org/

Johnson, Zoe Pfahl. 2000. A Sea Level Rise Response Strategy for the State of Maryland. Prepared for MDNR. 49 Pgs.
http://www.dnr.state.md.us/bay/czm/sea_level_rise.html

Maryland Department of Agriculture. 2003. *Making Nutrient Management Work.* Nutrient Management Program, 2003 Annual Report.
http://www.mda.state.md.us/pdf/nmar03.pdf

MDE. Code of Maryland Regulations (COMAR).
http://www.mde.state.md.us/programs/waterprograms/tmdl/wqstandards/index.asp

MDE Fish Consumption Advisories:
http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/home/index.asp

MDE Shellfish Certification Division:
http://www.mde.state.md.us/CitizensInfoCenter/FishandShellfish/harvesting_notices/index.asp

MDE Wetlands and Waterways Program web site:
http://www.mde.state.md.us/Programs/WaterPrograms/Wetlands_Waterways/index.asp

MDE. 1996. Maryland's 303(d) lists: *1996 303(d) List of Water Quality Limited Basin Segments* and *2004 List of Impaired Surface Waters [303(d) List]*.
http://www.mde.state.md.us/

MDE. 1999. TMDLs of Nitrogen and Phosphorus for Port Tobacco River, Charles County. (Approved March 18, 1999)
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/ApprovedFinalTMDL/tmdl_porttobacco.asp

MDE. 2002. *Description of Closed and Conditionally Approved Shellfish Waters, December 31, 2002.* Technical and Regulatory Services Administration.
MDE. 2006. *Priority Areas for Wetland Restoration, Preservation, and Mitigation in Maryland (draft).* Denise Clearwater, Nontidal Wetlands and Waterways Division.

MDE Searchable database for the 303(d) List:
http://www.mde.state.md.us/Programs/WaterPrograms/TMDL/Maryland%20303%20dlist/303d_search/

MDNR. 1998. Maryland Clean Water Action Plan.
http://www.dnr.state.md.us/cwap/cwap.htm

MDNR Bay Grasses:
http://www.dnr.state.md.us/bay/sav/about.asp

MDNR Fisheries, Recreational Fisheries articles:
http://www.dnr.state.md.us/fisheries/recreational/articles/tidalbass.html

MDNR Fisheries, Blue Crab Program:
http://www.dnr.state.md.us/fisheries/crab/winter_dredge.html

MDNR Fisheries, Dividing Lines, Tidal and Nontidal Waters:
http://www.dnr.state.md.us/fisheries/regulations/dividinglines.html

MDNR Fisheries, Fish Passage:
http://www.dnr.state.md.us/fisheries/articles/fishpassage02.html

MDNR Fisheries, Non-tidal Hook and Line Fishing Seasons:
http://www.dnr.state.md.us/fisheries/regulations/nontidalregs.html

MDNR Fisheries, Striped Bass Seine Survey:
http://www.dnr.state.md.us/fisheries/juvindex/index.html

MDNR Fisheries, Yellow Perch Fact Sheet:
http://www.dnr.state.md.us/fisheries/education/yellowperch/yperch.html

MDNR Fisheries, Yellow Perch Status Report:
http://www.dnr.state.md.us/fisheries/recreational/WPYP/YPstatus.html

MDNR Forest Service, 2003. *Maryland's Strategic Forest Lands Assessment*.
http://www.dnr.state.md.us/forests/download/sfla_report.pdf

MDNR MBSS home page:
http://www.dnr.state.md.us/streams/mbss/index.html

MDNR MBSS on-line database: http://mddnr.chesapeakebay.net/mbss/search.cfm

MDNR MBSS, "Charles County: Results of the 1994-1997 Maryland Biological Stream Survey." CBWP-MANTA-EA-01-28.
http://www.dnr.state.md.us/streams/pubs/county/ea01-28_charles.pdf

MDNR MBSS Basin Reports and Fact Sheets:
http://www.dnr.state.md.us/streams/mbss/mbss_fs_table.html

MDNR Natural Heritage Program:
http://www.dnr.state.md.us/wildlife/espaa.asp

MDNR News Release. 2003. "DNR announces good news about SAV but cautions much more progress needed."
http://www.dnr.state.md.us/dnrnews/pressrelease2003/092503a.html

MDNR, Power Plant Siting Program. 1979. "Environmental Atlas of the Potomac Estuary," Williams & Heintz Map Corporation, Washington D.C.

MDNR Stream Corridor Assessment Manual:
http://www.dnr.state.md.us/streams/stream_corridor.html

MDNR Stream Waders Program and publications:
http://www.dnr.state.md.us/streams/mbss/mbss_volun.html
Stream Waders database: http://mddnr.chesapeakebay.net/mbss/streamwaders.cfm

MDNR Watershed Indicators:
http://www.dnr.state.md.us/watersheds/surf/indic/md/md_indic.html

MDNR Watershed Indicators, Benthic macroinvertebrates:
http://www.dnr.state.md.us/watersheds/surf/indic/md/descrip/md_ntben_des.html

MDNR Watershed Profiles:
http://mddnr.chesapeakebay.net/wsprofiles/surf/prof/prof.html

MDNR Watershed Profiles, Port Tobacco River:
http://mddnr.chesapeakebay.net/wsprofiles/surf/prof/wsprof.cfm?watershed=02140109

Maryland Geological Survey (MGS):
http://www.mgs.md.gov/hydro/somdbgrd.htm

Tiner, R. W. and D. G. Burke. 1995. *Wetlands of Maryland.* Maryland Department of Natural Resources, Annapolis, MD and U.S. Fish and Wildlife Service, Hadley, MA. Cooperative National Wetlands Inventory Report.

University of Maryland, College of Agriculture and Natural Resources. 1998. *A Citizen's Guide to the Water Quality Improvement Act of 1998.* http://www.agnr.umd.edu/waterquality/CitizWQ.html

USGS Groundwater: http://md.water.usgs.gov/groundwater/web_wells/current/confined/counties/charles/

USGS National Hydrology Dataset http://nhd.usgs.gov/

Walbeck, David. 2005. Regulated wetland impact data for the period between 1991 and 2005. Maryland Department of the Environment. Wetlands and Waterways Program. Baltimore, MD.

APPENDIX A: Current Rare, Threatened, and Endangered Species of Port Tobacco River Watershed (02140109) 2005 (MDNR Natural Heritage Program, 2005)

Scientific Name	Common Name	G-rank	S-rank	MD	US
Haliaeetus leucocephalus	Bald Eagle	G4	S2S3B	T	LT
Festuca paradoxa*	Cluster Fescue	G5	S1	X	
Iris verna	Dwarf Iris	G5	S1	E	
Myosotis macrosperma	Large-seeded Forget-me-not	G5	S2S3		
Nemophila aphylla	Small-flowered Baby-blue-eyes	G5	S1		

OTHER Biological Resources of Concern to DNR's Wildlife & Heritage Service:
Forest Interior Dwelling Species Habitat
Waterfowl Concentration & Staging Areas

Historical Rare, Threatened, and Endangered Species of Port Tobacco River Watershed (02140109) as of August 25, 2005

Aeschynomene virginica	Sensitive Joint-vetch	G2	S1	E
Ambystoma tigrinum	Eastern Tiger Salamander	G5	S2	E
Carex silicea	Sea-beach Sedge	G5	S1	E
Eleocharis albida	White Spikerush	G4G5	S2	T
Gentiana andrewsii	Fringe-tip Closed Gentian	G5?	S2	T
Hermeuptychia sosybius	Carolina Satyr	G5	S1S3	
Hexastylis virginica	Virginia Heartleaf	G4	S1	E
Ludwigia decurrens	Primrose Willow	G5	S2S3	
Matelea carolinensis	Anglepod	G4	S1	E
Potamogeton perfoliatus	Clasping-leaved Pondweed	G5	S2	
Potamogeton richardsonii	Redheadgrass	G5	SH	X

*Festuca paradoxa was rediscovered in 2002.

EXPLANATION OF RANK AND STATUS CODES FOR RTE LIST

January 26, 2003

(From MDNR Natural Heritage Program)

The global and state ranking system is used by all 50 state Natural Heritage Programs and numerous Conservation Data Centers in other countries in this hemisphere. Because they are assigned based upon standard criteria, the ranks can be used to assess the range-wide status of a species as well as the status within portions of the species' range. The primary criteria used to define these ranks are the number of known distinct occurrences with consideration given to the total number of individuals at each locality. Additional factors considered include the current level of protection, the types and degree of threats, ecological vulnerability, and population trends. Global and state ranks are used in combination to set inventory, protection, and management priorities for species both at the state as well as regional level.

GLOBAL RANK

G1 Highly globally rare. Critically imperiled globally because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres) or because of some factor(s) making it especially vulnerable to extinction.

G2 Globally rare. Imperiled globally because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres) or because of some factor(s) making it very vulnerable to extinction throughout its range.

G3 Either very rare and local throughout its range or distributed locally (even abundantly at some of its locations) in a restricted range (e.g., a single western state, a physiographic region in the East) or because of other factors making it vulnerable to extinction throughout its range; typically with 21 to 100 estimated occurrences.

G4 Apparently secure globally, although it may be quite rare in parts of its range, especially at the periphery.

G5 Demonstrably secure globally, although it may be quite rare in parts of its range, especially at the periphery.

GH No known extant occurrences (i.e., formerly part of the established biota, with the expectation that it may be rediscovered).

GU Possibly in peril range-wide, but its status is uncertain; more information is needed.

GX Believed to be extinct throughout its range (e.g., passenger pigeon) with virtually no likelihood that it will be rediscovered.

G? The species has not yet been ranked.

_Q Species containing a "Q" in the rank indicates that the taxon is of questionable or uncertain taxonomic standing (i.e., some taxonomists regard it as a full species, while others treat it at an infraspecific level).

_T Ranks containing a "T" indicate that the infraspecific taxon is being ranked differently than the full species.

STATE RANK

S1 Highly State rare. Critically imperiled in Maryland because of extreme rarity (typically 5 or fewer estimated occurrences or very few remaining individuals or acres in the State) or because of some factor(s) making it especially vulnerable to extirpation. Species with this rank are actively tracked by the Natural Heritage Program.

S2 State rare. Imperiled in Maryland because of rarity (typically 6 to 20 estimated occurrences or few remaining individuals or acres in the State) or because of some factor(s) making it vulnerable to becoming extirpated. Species with this rank are actively tracked by the Natural Heritage Program.

S3 Rare to uncommon with the number of occurrences typically in the range of 21 to 100 in Maryland. It may have fewer occurrences but with a large number of individuals in some populations, and it may be susceptible to large-scale disturbances. Species with this rank are not actively tracked by the Natural Heritage Program.

S3.1 A species that is actively tracked by the Natural Heritage Program because of the global significance of Maryland occurrences. For instance, a G3 S3 species is globally rare to uncommon, and although it may not be currently threatened with extirpation in Maryland, its occurrences in Maryland may be critical to the long-term security of the species. Therefore, its status in the State is being monitored.

S4 Apparently secure in Maryland with typically more than 100 occurrences in the State or may have fewer occurrences if they contain large numbers of individuals. It is apparently secure under present conditions, although it may be restricted to only a portion of the State.

S5 Demonstrably secure in Maryland under present conditions.

SA Accidental or considered to be a vagrant in Maryland.

SE Established, but not native to Maryland; it may be native elsewhere in North America.

SH Historically known from Maryland, but not verified for an extended period (usually 20 or more years), with the expectation that it may be rediscovered.

SP Potentially occurring in Maryland or likely to have occurred in Maryland (but without persuasive documentation).

SR Reported from Maryland, but without persuasive documentation that would provide a basis for either accepting or rejecting the report (e.g., no voucher specimen exists).

SRF Reported falsely (in error) from Maryland, and the error may persist in the literature.

SU Possibly rare in Maryland, but of uncertain status for reasons including lack of historical records, low search effort, cryptic nature of the species, or concerns that the species may not be native to the State. Uncertainty spans a range of 4 or 5 ranks as defined above.

SX Believed to be extirpated in Maryland with virtually no chance of rediscovery.

SYN Currently considered synonymous with another taxon and, therefore, not a valid entity.

SZ A migratory species which does not inhabit specific locations for long periods of time.

S? The species has not yet been ranked.

-B This species is migratory and the rank refers only to the breeding status of the species. Such a migrant may have a different rarity rank for non-breeding populations.

-N This species is migratory and the rank refers only to the non-breeding status of the species.
Such a migrant may have a different rarity rank for breeding populations.

STATE STATUS

This is the status of a species as determined by the Maryland Department of Natural Resources, in accordance with the Nongame and Endangered Species Conservation Act. Definitions for the following categories have been taken from Code of Maryland Regulations (COMAR) 08.03.08.

E Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.

I In Need of Conservation; an animal species whose population is limited or declining in the State such that it may become threatened in the foreseeable future if current trends or conditions persist.

T Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.

X Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.

* A qualifier denoting the species is listed in a limited geographic area only.

PE Proposed Endangered; a species whose continued existence as a viable component of the State's flora or fauna is determined to be in jeopardy.

PT Proposed Threatened; a species of flora or fauna which appears likely, within the foreseeable future, to become endangered in the State.

PX Proposed Endangered Extirpated; a species that was once a viable component of the flora or fauna of the State, but for which no naturally occurring populations are known to exist in the State.

PD Proposed to be deleted or removed from the State Threatened & Endangered Species list.

FEDERAL STATUS

This is the status of a species as determined by the U.S. Fish and Wildlife Service's Office of Endangered Species, in accordance with the Endangered Species Act. Definitions for the following categories have been modified from 50 CRF 17.

LE Taxa listed as endangered; in danger of extinction throughout all or a significant portion of their range.

LT Taxa listed as threatened; likely to become endangered within the foreseeable future throughout all or a significant portion of their range.

PE Taxa proposed to be listed as endangered.

PT Taxa proposed to be listed as threatened.

C Candidate taxa for listing for which the Service has on file enough substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened.

APPENDIX B

GREEN INFRASTRUCTURE

Green Infrastructure Assessment
Port Tobacco River Watershed

August 2005

Maryland Department of Natural Resources

Introduction

The Port Tobacco River watershed is a tributary of the Potomac River that is entirely within Charles County, Maryland. Large blocks of natural resource lands in this watershed, as well as elsewhere in the State, provide valuable water quality and habitat benefits. These areas are primarily large blocks of contiguous forest but also include wetlands and other naturally vegetated lands. In general, actions taken to prevent conversion to other land uses, to avoid forest fragmentation, and to restore forest in areas that have been cleared will contribute significantly to maintaining and improving water quality in this watershed and to conserving Maryland's biodiversity.

To assist in protection and tracking of natural resource areas that are important at the landscape scale, Maryland Department of Natural Resources (DNR) mapped a statewide network of ecologically important lands collectively called "Green Infrastructure." This Green Infrastructure provides the bulk of the state's natural support system. It delivers ecosystem services, such as cleaning the air, filtering and cooling water, storing and cycling nutrients, conserving and generating soils, pollinating crops and other plants, regulating climate, protecting areas against storm and flood damage, and maintaining hydrologic function.

Green Infrastructure, as defined by DNR represents natural resource conditions on the ground. In general, the Green Infrastructure network is comprised of large blocks of ecologically important natural resource lands called hubs and corridors that link the hubs. Hubs contain one or more of the following:

- Areas containing sensitive plant or animal species;
- Large blocks of contiguous interior forest (at least 250 contiguous acres, plus the 300 foot transition zone);
- Wetland complexes with at least 250 acres of unmodified wetlands;
- Streams or rivers with aquatic species of concern, rare coldwater or blackwater ecosystems, or important to anadromous fish, and their associated riparian forest and wetlands; and
- Conservation areas already protected by public (primarily DNR or the federal government) and private organizations like The Nature Conservancy or Maryland Ornithological Society.

For more information on how Maryland's Green Infrastructure was identified and previously published reports that reflect conditions in the 1990s, see www.dnr.maryland.gov/greenways/

Local Findings

Across Maryland, new development, land management changes and other on-the-ground activities are changing Green Infrastructure in measurable ways compared to conditions in the 1990s when it was originally identified. Until a fully updated Green Infrastructure assessment can be performed to comprehensively account for these changes, an interim approach has been devised to gauge current conditions in the Green Infrastructure. The

interim approach employs the Green Infrastructure boundaries for hubs and corridors, as defined in DNR's original analysis, like cookie cutters on Maryland Department of Planning 2002 land use data. This approach acknowledges land use changes that have occurred within Maryland's Green Infrastructure since it was initially identified.

The map *Green Infrastructure – 2002 Land Use* shows several findings for Port Tobacco River watershed:

- Natural vegetation, including forest and wetlands, cover about 79% of the total area identified as Green Infrastructure in the watershed. For the Green Infrastructure hubs and corridors, natural vegetation covers about 87% and 61% respectively.
- Agriculture accounts for about 9% of the hubs and 15% of the corridors.
- Development covers about 4% of the hubs and 12% of the corridors.

Change Over Time

Using the same approach described for 2002 data, the existing Green Infrastructure hub and corridor boundaries are applied like cookie cutters on Maryland Department of Planning 1973 land use data. The map *Green Infrastructure – 1973 Land Use* shows the results. By comparing the differences within the hub and corridor boundaries for 1973 and 2002, an estimate of land use change in the hubs and corridors for over nearly 30 years can be generated. Several findings from the comparison are summarized below:

- In hubs, natural vegetation, including forest and wetlands, declined about 40 acres or one percent between 1973 and 2002. Agricultural acreage dropped about 164 acres while developed land increased about 193 acres. These changes in the hubs suggest that their natural resource values are probably being eroded as their rural character is changing to an increasingly suburban land use mix.
- In corridors, land use change between 1973 and 2002 is greater than in the hubs. Natural vegetation area has declined about 313 acres or about 7% of the area. Agriculture has lost about 60 acres. Development increased about 344 acres – from 4% to 12% of the area. These changes suggest that the natural resources values of the corridors and the connectivity that they provide between hubs are diminishing as a result of increasing development.

Interpreting Hub Ranking

The map *Green Infrastructure Hub Rank* shows that there are 44 Green Infrastructure hubs in Charles County. From the perspective of the statewide analysis that was used to identify the hubs, all hubs identified in Maryland's Green Infrastructure are important in the State's network of natural resource areas.

The ecological values associated with each hub differ in ways that can be used to compare and prioritize them for potential management action. The "Eco-Region Percent Rank" shown in the map presents one of many possible views for comparing the hubs. To interpret this ranking effectively, it is important to understand what this ranking represents. It is a scale from 1 to 100 that incorporates measurements of on-the-ground

conditions like size for the contiguous area, sensitive species, vegetation conditions and many other measures related to ecological condition. In general, larger hubs are ranked closer to "1" and smaller hubs are ranked closer to "100". The relative size of the GI hubs is one measure of their importance regionally in Maryland network of natural areas. The smaller hubs are important on the local scale by contributing to conditions in local streams. Numerous other measurements of environmental integrity also contribute to this ranking.

For all hubs, two important management objectives generally apply:

- Maintaining/enhancing integrity of the large block natural area already in the hub.
- Maintaining/enhancing connectivity between two or more hubs so that they can function collectively in the natural resource network.

For larger hubs, maintaining hub integrity tends to be relatively important. For smaller hubs, enhancing connectivity, i.e. allowing two hubs to function as one larger hub, is an increasingly important management objective.

Local Hub Findings

Findings for individual Green Infrastructure (GI) hubs are presented in three tables at the end of this section. The Table 1 includes a simple description and a suggested name for each hub based on one or two attributes identified during the analysis including park names, stream names or nearby roads. Table 2 summarizes the kinds of protection identified in the hub that could affect potential for land use conversion to development within the hub. Table 3 summarizes several types of natural resource conditions or presence of areas designated in State regulation.

Findings that apply to more than one hub in Charles County are summarized in the following list:

- The majority of land in Green Infrastructure (GI) hubs within Charles County is privately owned. Most of this private land does not have protection from conversion to development or other land uses. Charles County's Rural Legacy area encompasses portions of two hubs, which include Rural Legacy easements that have already been purchased. DNR's data base lists only two or three agricultural easements in Charles County, which may be incomplete.
- Public ownership in fee simple or easement to protect natural resources covers some portions of GI hubs. Federal ownership, primarily in fee simple and associated with military functions, is found in five hubs within Charles County. State ownership in fee simple is found in 18 hubs and in easement in 12 hubs. County ownership for parks is found in five GI hubs.
- Forest interior habitat is found in all GI hubs in Charles County.
- 100-Year floodplains are found in nearly all GI hubs in Charles County.
- Sensitive Species habitat is found in most GI hubs in Charles County. Wetlands of Special State Concern are located in 25% of the hubs (11 out of 44).

Table 1. Green Infrastructure Hub Rank For Charles County Scale for Rank is from 0 (important larger hubs) to 100 (also important but smaller hubs)		
Map Key	Percent Rank	Green Infrastructure Hub Description
1	0.5	Nanjemoy Creek hub.
2	2.7	Zekiah Swamp between Rt 234 and Rt 6 including Clark Run tributary area.
3	3.2	Zekiah Swamp between Rt 6 and Rt 5 including headwaters of Gilbert Swamp Run and the connecting forest lands.
4	3.8	Piscataway Park hub including natural lands east of Rt 227 and the contiguous forest blocks along the County line down to Rt 210.
5	4.3	Beaverdam Creek hub including all contiguous natural lands between Rt 224 and Rt 6 north to Rt 344.
6	4.9	Myrtle Grove and Port Tobacco headwaters. Includes all contiguous natural lands north of Rt 225, south of Routes 224 and 227 and west of Rt 301.
7	6.5	Popes Creek hub including most natural land west of Rt 301 and south of Chapel Point Road.
8	7	Chicamuxen Creek hub including natural lands in and around the Chicamuxen WMA, Navy Center lands and Smallwood State Park.
9	7.6	Allens Fresh / Budds Creek hub includes most natural land between Rt 234 and the Wicomico River.
10	8.1	Thomas Stone / Mount Pisgah hub includes an area natural land running from Port Tobacco Creek west to Rt 425 bounded by Rt 225 on the north.
11	9.2	Pomokey Creek hub includes Ruth Swann Park and Chapman State Park. It is bounded by Rt 227 on the east and Rt 210 on the south.
12	9.7	Zekiah headwaters hub includes Cedarville State Forest and other natural lands north of Rt 5.
13	10.3	Maryland Point hub includes natural lands south of Rt 224 between Smith Point and Marcy Point at Rt 6.
14	13	Kerrick Swamp / Piney Branch headwaters hub includes natural lands bounded by Rt 488 on the south, Radio Station Road on the west, St. Charles on the north, and Rt 5 on the east.
15	13.5	Swanson Creek hub includes the natural lands bounded by Rt 231 on the south and Rt 381 on the west.
16	14.1	Indian Creek hub includes the Indian Creek WMA and natural lands in the vicinity south of Rt 231.
17	15.7	Lower Mattawoman Creek hub includes the Mattawoman NEA and other natural lands north of Rt 224.
18	17.3	Chapmans Landing hub includes natural lands bounded by Rt 224 on the south, Rt 225 on the west and Rt 210 on the north.
19	18.4	Mattawoman / Old Womans Run hub runs along Matawoman from Rt 227 to Rt 228.
20	19.5	Swanson Creek headwaters hub includes natural lands north of

		Hughesville north into Prince George's County and west into the headwaters of Mill Dam Run.
21	20.5	Wards Run headwaters hub includes natural lands bounded by Rt 6 on the south, Rt 425 on the west Poor House Road on the north and Annapolis Woods Road on the east.
22	21.1	Purse State Park-area hub is along the Potomac River west of Rt 224 bewteen Smith Point to Mallows Bay.
23	21.6	Sandy Point hub is along the Potomac River west of Rt 224 between Mallows Bay to Budds Ferry Road.
24	28.1	Budds Creek headwaters hub straddles the Charles/St. Mary's County line north of Rt 234.
25	28.6	Hancock Run hub is bounded by Rt 425 on the east and south, and by Rt 6 on the west and north. It includes the portion of Doncaster State Demonstration Forest south of Rt 6.
26	29.2	Blossom Point hub includes most natural lands in the peninsula.
27	29.7	Doncaster State Demo Forest hub includes most natural lands bounded by Rt 6 on the south, Rt 344 on the west, Rt 224 on the north and Rt 425 on the east.
28	31.9	Chapel Point hub includes the State Park and natural lands up to the headwaters of Wills Branch.
29	32.4	Upper Mattawoman Creek hub straddles the Charles / Prince George's County border running along Mattawoman Creek from Rt 228 to Rt 301.
30	34.1	Trinity Church Run headwaters hub includes the natural lands bounded by the County border on the east, Ryceville Road on the south, Trinity Church & Dubois Road on the west and Rt 6 on the north.
31	35.1	Mattawoman Tributaries hub includes most of the natural lands along Mattawoman Creek tributaries west of Waldorf. It is bounded by Rt 229 on the west, Rt 228 on the north, and Waldorf & Rt 301 on the east.
32	42.7	Persimmon Point hub is north of Mount Victoria on the Wicomico River.
33	43.2	Hatton Creek hub.
34	45.9	Gilbert Swamp Run between Trinity Church Road and Rt 6.
35	47.0	St. Steven Run hub between Penns Hill Road and Gilbert Swamp south of Rt 6.
36	55.7	Marbury Run hub includes portions of the Mattawoman NEA south of Rt 244 and natural land along Marbury Run.
37	56.2	Mill Run headwaters hub is upstream of Rt 257 west of Mount Victoria.
38	56.8	Gilbert Swamp immediated north of Rt 234.
39	73.0	Clark Run hub in La Plata.
40	75.1	Ravens Crest Creek headwaters hub is between Popes Creek Road and Rt 301.
41	76.2	Pasquahanza Creek hub is immediately south of Route 301 near the

		Morgantown Generating Plant.
42	85.9	Bullitt Neck hub is north of Rt 224 on Mattawoman Creek.
43	88.6	Neale Sound hub is south of Issue
44	90.3	Gilbert Pond headwaters hub west of Hughesville and south of Hughesville Pond and north of Rt 231 on an unnamed tributary to Gilbert Pond.

Table 2. Green Infrastructure Protection Summary For Charles County Based On DNR GIS Data August 2005								
Map Key Hub #	Public Ownership			Private Ownership				
	Federal Park	State Park	County Park	Ag Easmt	Rural Legacy		MET orDNR Easmt	Other Conserv Easmt
					In Area	Easmt		
1	--	Y	Y	--	--	--	Y	Y
2	--	Y	Y	--	--	--	--	--
3	--	--	--	--	P	Y	Y	--
4	Y	--	--	--	--	--	--	--
5	--	Y	--	--	--	--	--	Y
6	--	Y	--	--	--	--	Y	--
7	--	--	--	--	--	--	Y	--
8	Y	Y	--	--	--	--	Y	--
9	--	Y	--	Y	--	--	--	--
10	--	--	--	--	--	--	Y	--
11	Y	Y	Y	--	--	--	Y	--
12	Y (PG)	Y	--	--	P	Y	Y	--
13	--	--	--	--	--	--	--	--
14	--	--	--	--	--	--	--	--
15	--	Y	--	--	--	--	--	--
16	--	Y	--	--	--	--	--	--
17	--	Y	--	--	--	--	--	--
18	--	Y	--	--	--	--	--	--
19	--	--	Y	--	--	--	--	--
20	--	--	--	--	P	--	--	--
21	--	--	--	--	--	--	Y	--
22	--	Y	--	--	--	--	--	--
23	--	Y	--	--	--	--	--	--
24	--	--	--	--	--	--	--	--
25	--	Y	--	--	--	--	Y	--
26	Y	--	--	--	--	--	--	--
27	--	Y	--	--	--	--	Y	--
28	--	Y	--	--	--	--	Y	--
29	--	--	--	--	--	--	--	--
30	--	--	--	--	--	--	--	--
31	--	--	--	--	--	--	--	--
32	--	--	--	--	--	--	--	--
33	--	--	--	--	--	--	--	--
34	--	--	--	--	--	--	--	--
35	--	--	--	--	--	--	--	--
36	--	--	--	--	--	--	--	--
37	--	--	--	--	--	--	--	--
38	--	--	--	--	--	--	--	--

39	--	--	--	--	--	--	--	--
40	--	--	--	--	--	--	--	--
41	--	--	--	--	--	--	--	-
42	Y	Y	--	--	--	--	--	--
43	--	--	Y	--	--	--	--	--
44	--	--	--	--	--	--	--	--

Key: Y – Yes, this form of protection affect some portion of the hub;
A – All of the hub is within this area;
P- Part of the hub is within this area;
"-" Represents no or absence of this characteristic
MET – Maryland Environmental Trust

Table 3. Green Infrastructure Resource Summary For Charles County Based On DNR GIS Data August 2005				
Map Key Hub #	Forest Interior	Floodplain	SSPRA	WSSC
1	Y	Y	Y	Y
2	Y	Y	Y	Y
3	Y	Y	Y	Y
4	Y	Y	Y	--
5	Y	Y	Y	Y
6	Y	Y	Y	--
7	Y	Y	Y	Y
8	Y	Y	Y	Y
9	Y	Y	Y	Y
10	Y	Y	Y	--
11	Y	Y	Y	--
12	Y	Y	Y	Y
13	Y	Y	Y	--
14	Y	Y	Y	--
15	Y	Y	Y	--
16	Y	Y	Y	--
17	Y	Y	Y	Y
18	Y	Y	Y	--
19	Y	Y	Y	--
20	Y	Y	--	--
21	Y	Y	Y	--
22	Y	Y	Y	--
23	Y	Y	Y	--
24	Y	Y	--	--
25	Y	Y	Y	--
26	Y	Y	Y	--
27	Y	Y	Y	--
28	Y	Y	--	--
29	Y	Y	Y	--
30	Y	Y	--	--
31	Y	Y	Y	--
32	Y	--	--	--
33	Y	Y	Y	--
34	Y	Y	--	Y
35	Y	--	--	--
36	Y	Y	Y	--
37	Y	Y	Y	--
38	Y	Y	--	Y
39	Y	Y	--	--
40	Y	Y	Y	--

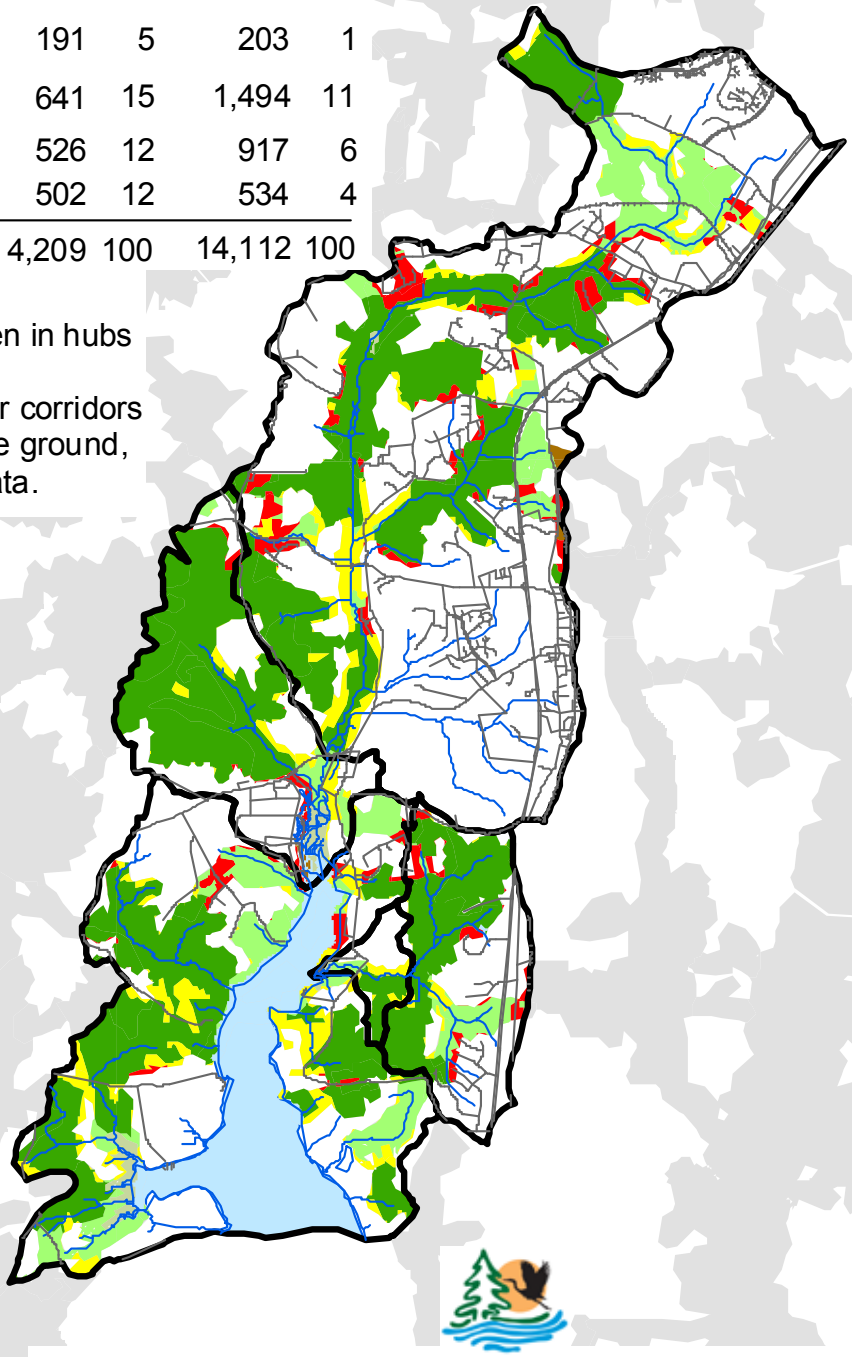
41	Y	Y	--	--
42	Y	Y	--	--
43	Y	Y	--	--
44	Y	Y	--	--

Key: Y – Yes, this characteristic is present.
"-" This characteristic is not present.
SSPRA – Sensitive Species Project Review Area
WSSC – Wetlands of Special State Concern

Green Infrastructure - 2002 Land Use
Port Tobacco River Watershed In Charles County

Land Use	Hubs Acres	Hubs %	Corridors Acres	Corridors %	Total Acres	Total %
Forest*	8,615	87	2,349	56	10,964	78
Wetlands	12	–	191	5	203	1
Agriculture	853	9	641	15	1,494	11
Developed	391	4	526	12	917	6
Other	32	–	502	12	534	4
Total	9,903	100	4,209	100	14,112	100

"Forest" is shown as darker green in hubs and as lighter green in corridors.
"Other" includes areas of hubs or corridors that are classified as beach, bare ground, wetlands or water in the MDP data.



Green Infrastructure Outside of Watershed
Subwatershed Boundaries
Water
Streams
Roads

0 0.5 1 2 Miles

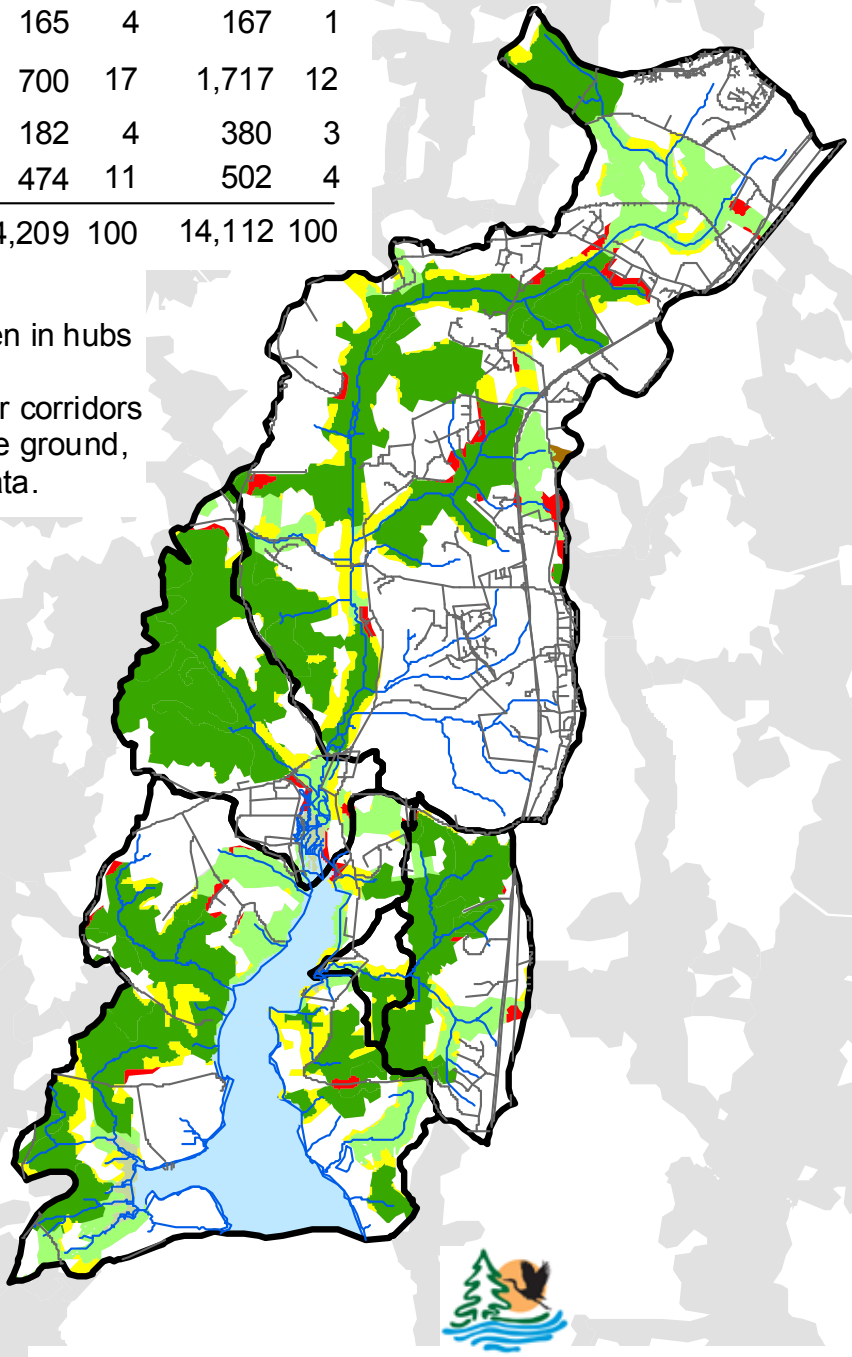
1:125,000

Maryland Dept. of Natural Resources
GIS: Watershed Services Center EAC Sep. 2005
Data: DNR

Green Infrastructure - 1973 Land Use
Port Tobacco River Watershed In Charles County

Land Use	Hubs Acres	Hubs %	Corridors Acres	Corridors %	Total Acres	Total %
Forest*	8,658	88	2,688	64	11,346	80
Wetlands	2	–	165	4	167	1
Agriculture	1,017	10	700	17	1,717	12
Developed	198	2	182	4	380	3
Other	28	–	474	11	502	4
Total	9,903	100	4,209	100	14,112	100

"Forest" is shown as darker green in hubs and as lighter green in corridors.
"Other" includes areas of hubs or corridors that are classified as beach, bare ground, wetlands or water in the MDP data.



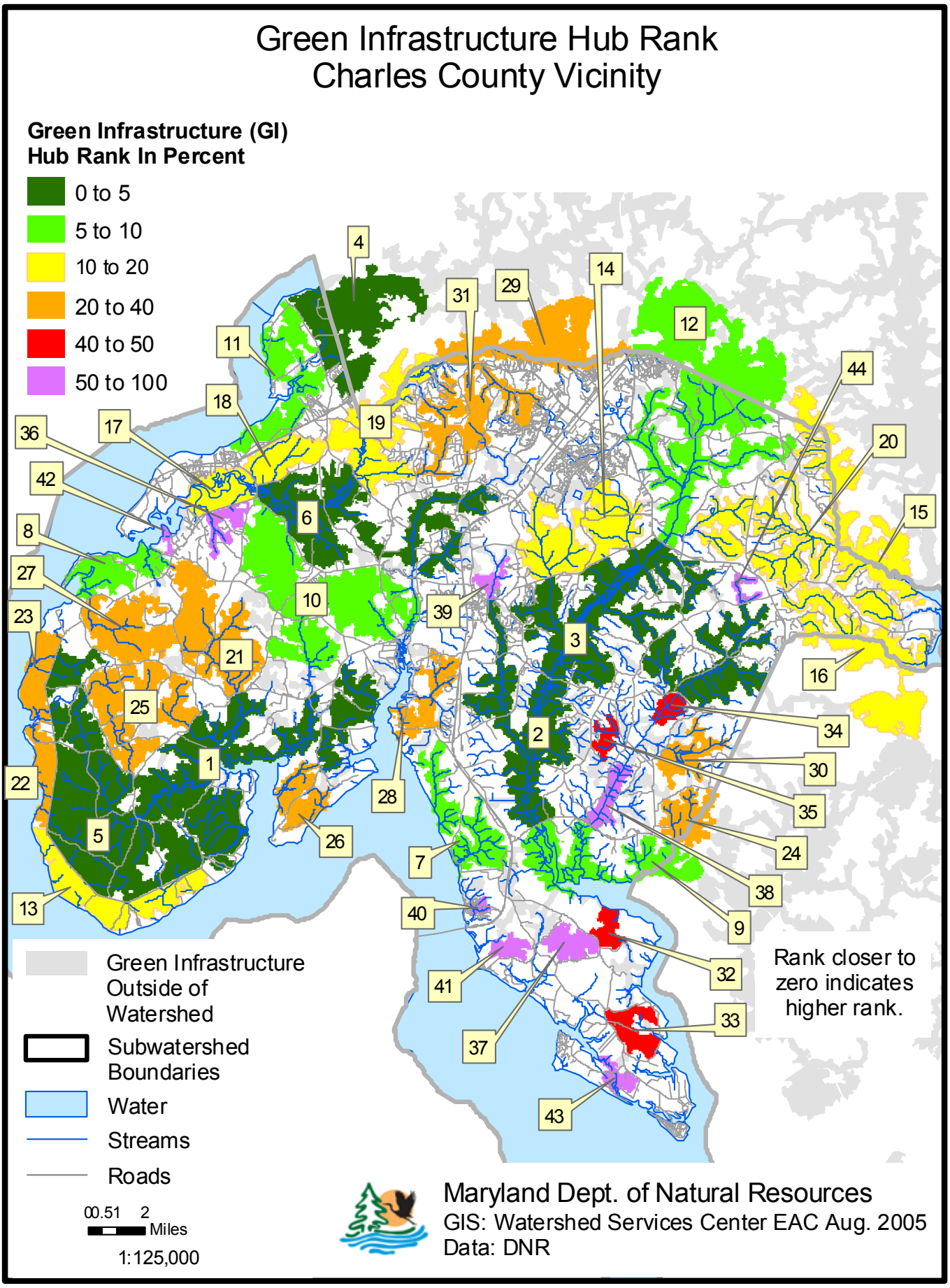
Green Infrastructure Outside of Port Tobacco Watershed
Subwatershed Boundaries
Water
Streams
Roads

0 0.5 1 2 Miles

1:125,000

Maryland Dept. of Natural Resources
GIS: Watershed Services Center EAC Sep. 2005
Data: DNR

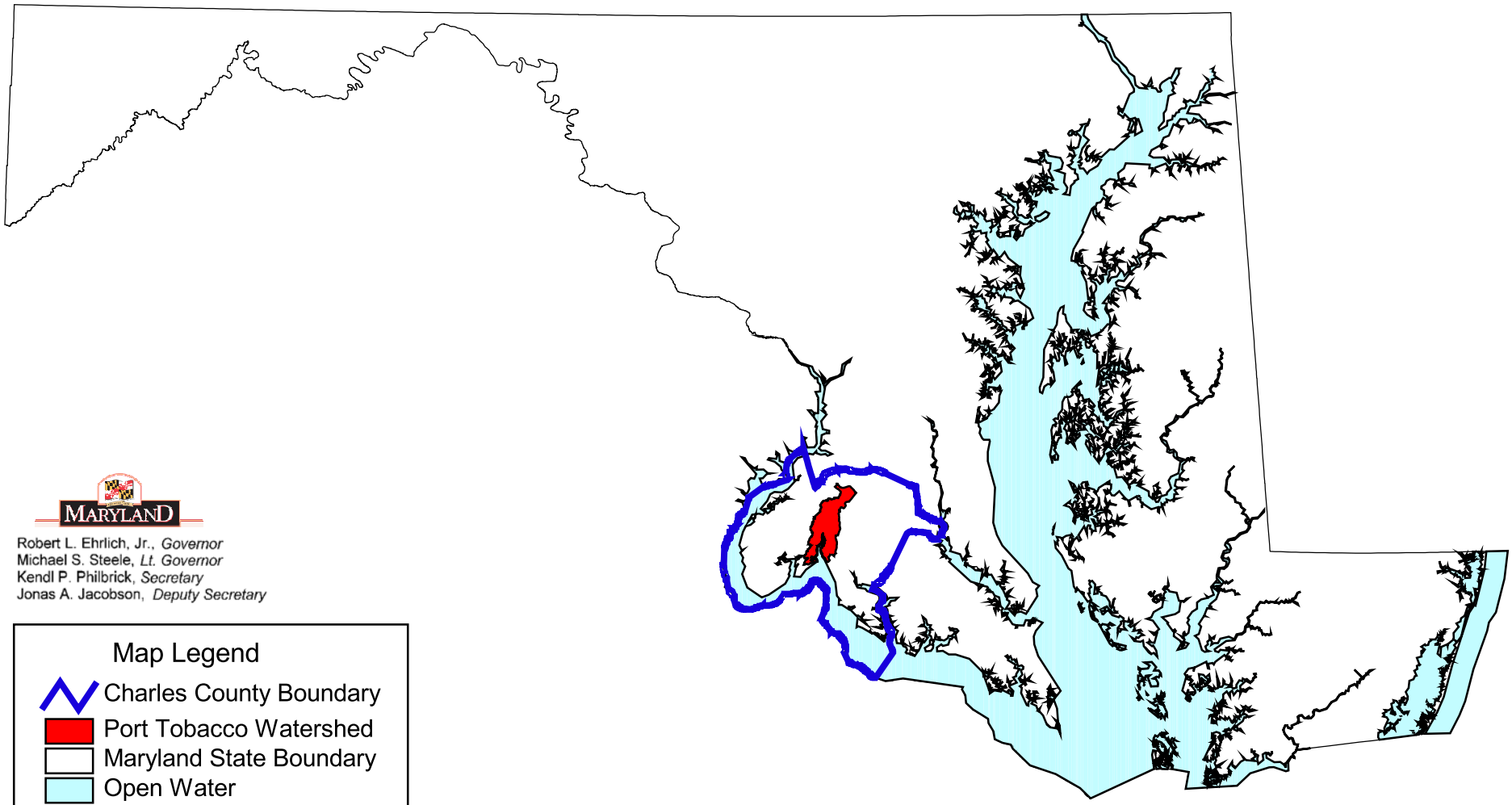
Green Infrastructure Hub Rank
Charles County Vicinity



Maryland Dept. of Natural Resources
GIS: Watershed Services Center EAC Aug. 2005
Data: DNR

PORT TOBACCO RIVER WATERSHED
CHARACTERIZATION MAPS

Map 1: Port Tobacco Watershed WRAS Project Area
Charles County, Maryland



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

- Charles County Boundary
- Port Tobacco Watershed
- Maryland State Boundary
- Open Water

MDE

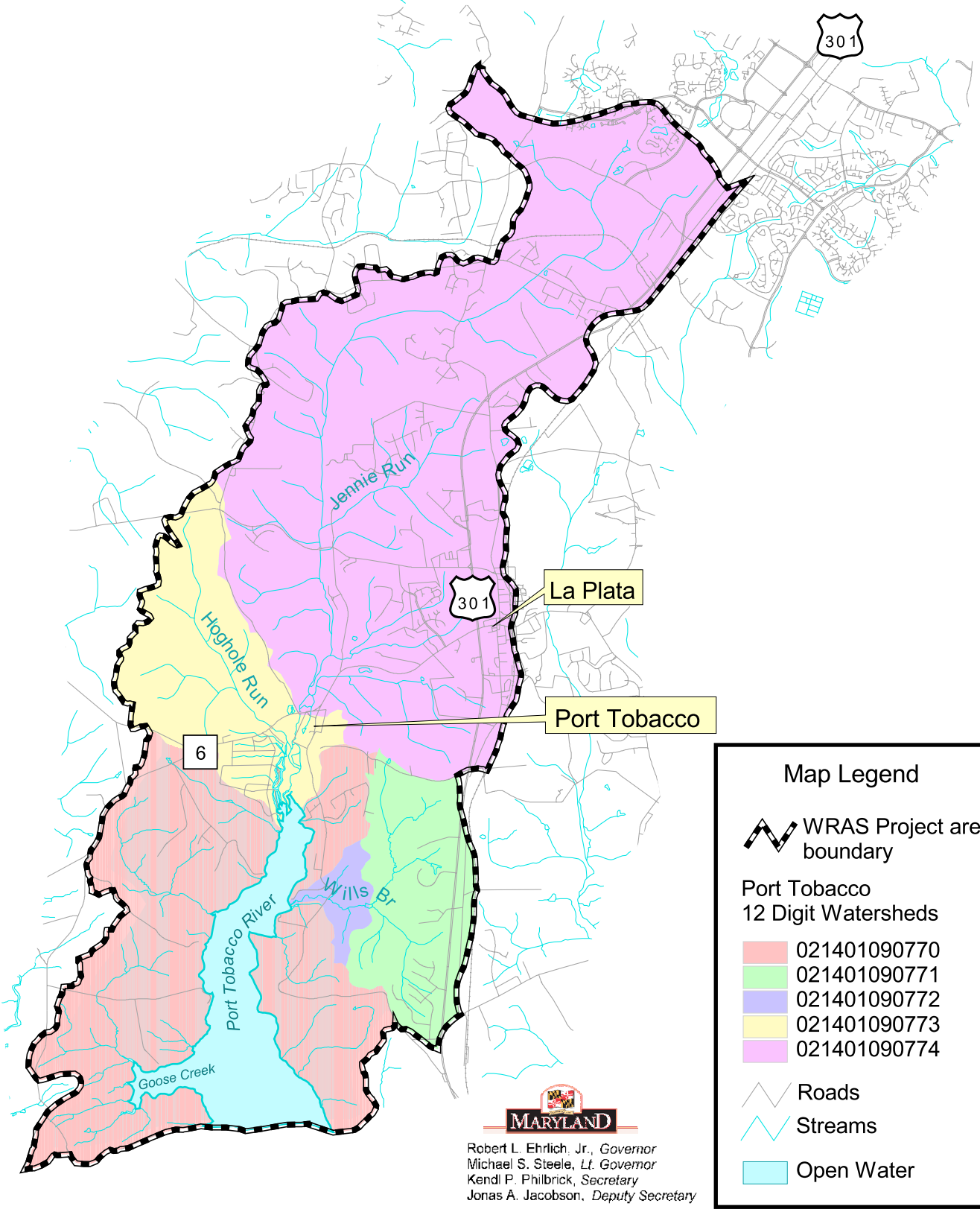
Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Natural Resources. The boundary layer is from the Maryland State Highway Administration. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 25 50 Miles

Scale: 1 to 700,000

Map 2: WRAS Project Area
Port Tobacco River Watershed Vicinity



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

WRAS Project area boundary

Port Tobacco
12 Digit Watersheds

- 021401090770
- 021401090771
- 021401090772
- 021401090773
- 021401090774

Roads

Streams

Open Water

MDE

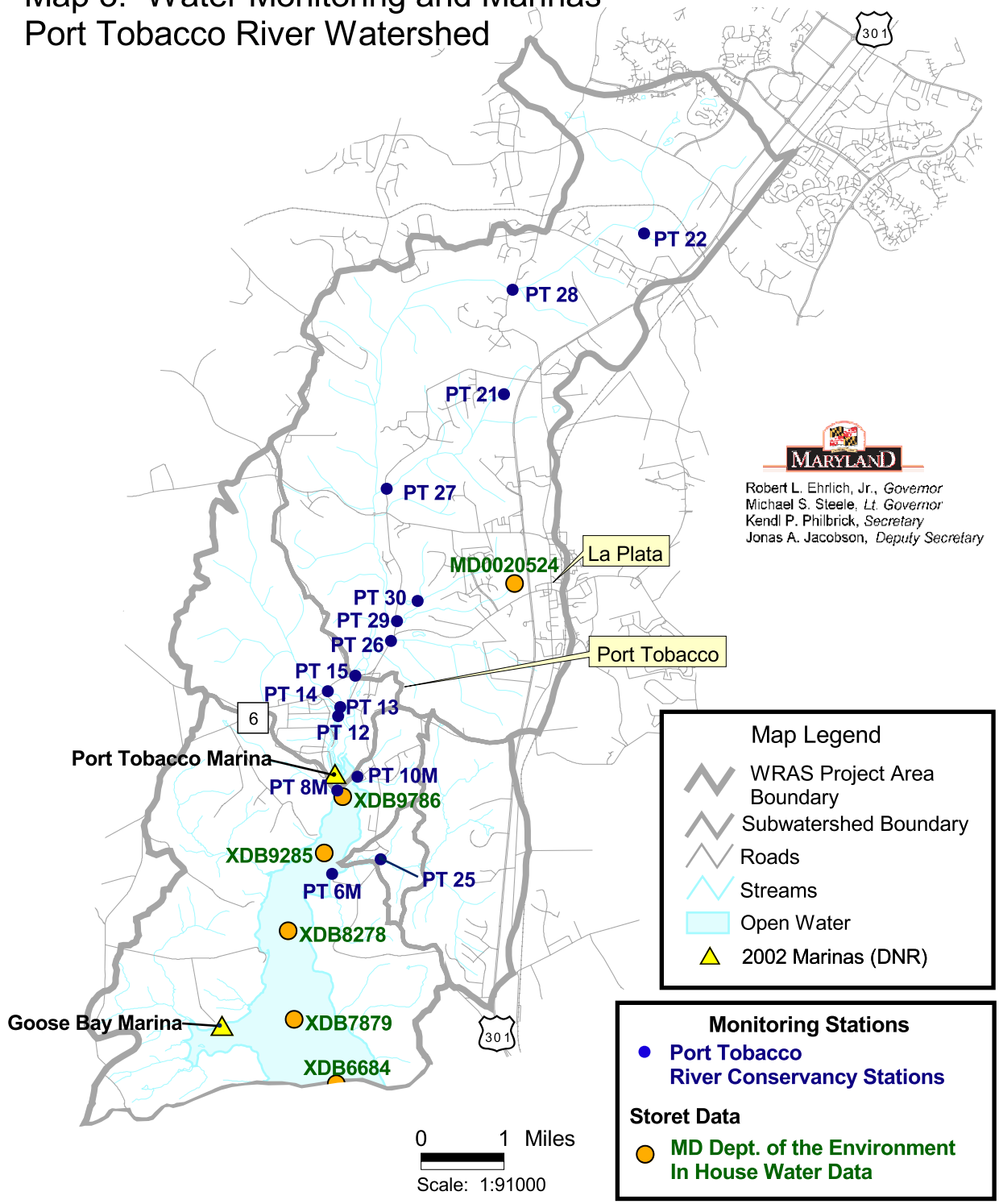
Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Natural Resources. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 1 Miles

Scale: 1:91000

Map 3: Water Monitoring and Marinas
Port Tobacco River Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary
- Roads
- Streams
- Open Water
- 2002 Marinas (DNR)

Monitoring Stations

- Port Tobacco River Conservancy Stations

Storet Data

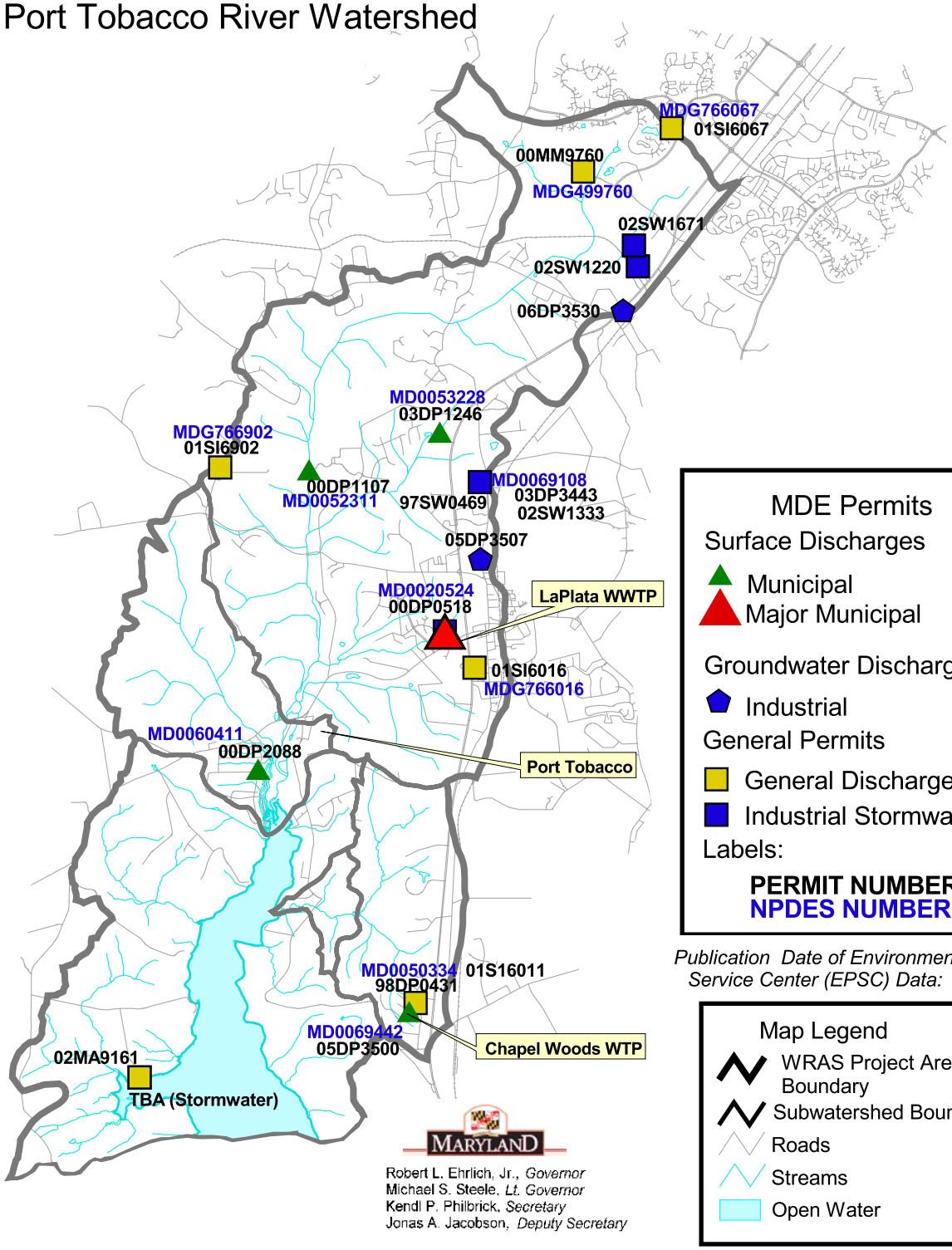
- MD Dept. of the Environment In House Water Data

MDE

Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Natural Resources. Water monitoring stations obtained from Port Tobacco River Conservancy and the U. S. Environmental Protection Agency's STORET database. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

Map 4: Point Sources
Port Tobacco River Watershed



MDE Permits

Surface Discharges

- Municipal
- Major Municipal

Groundwater Discharges

- Industrial

General Permits

- General Discharge
- Industrial Stormwater

Labels:

PERMIT NUMBER
NPDES NUMBER

Publication Date of Environmental Permit Service Center (EPSC) Data: 10/2005

Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary
- Roads
- Streams
- Open Water

MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

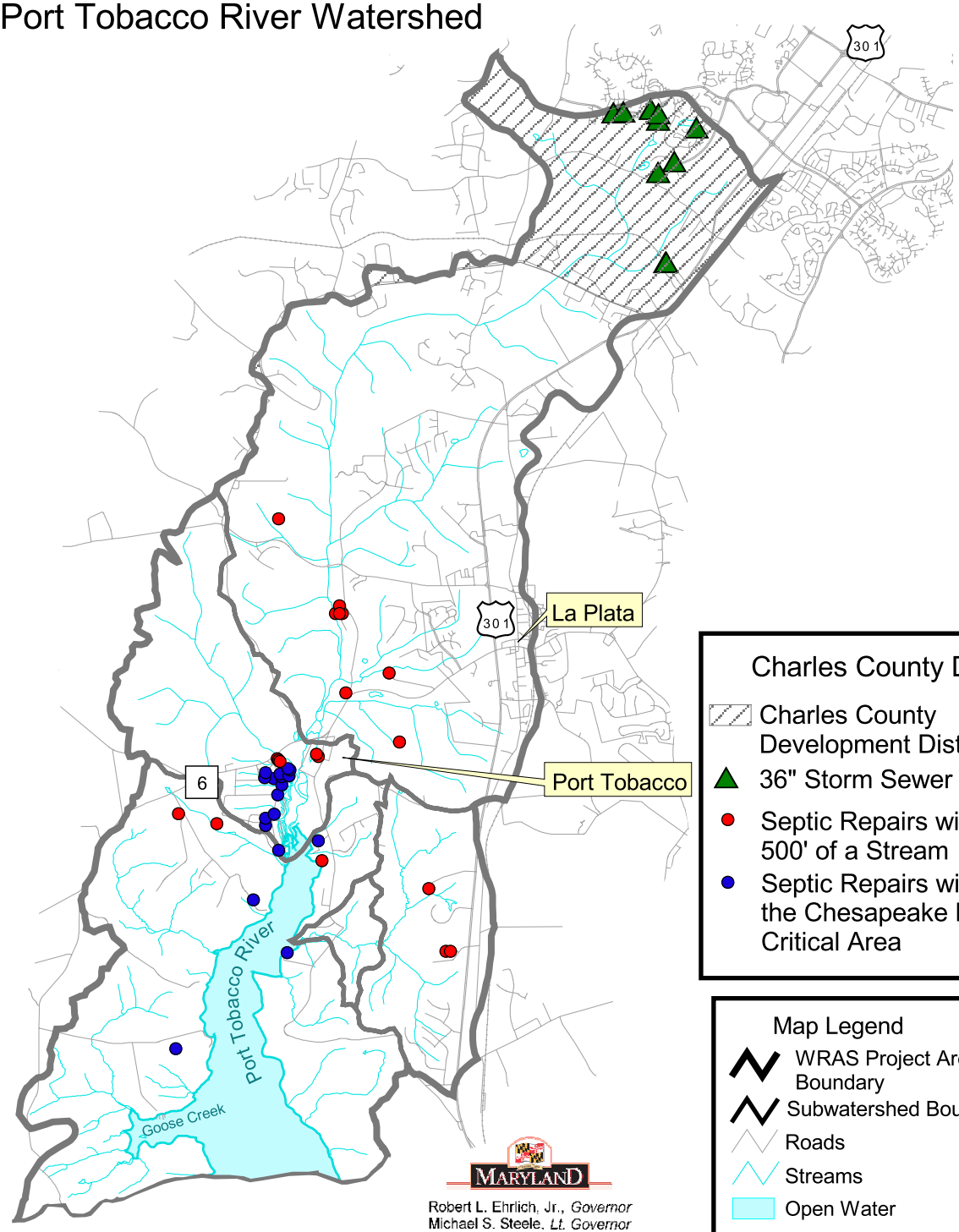
Map prepared by the Maryland Department of the Environment using data from MDE's EPSC database. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 2 Miles

Scale: 1:91,000

Map 5: County Data: Storm Sewer Outfalls and Septic Repairs
Port Tobacco River Watershed



Charles County Data

- Charles County Development District
- 36" Storm Sewer Outfalls
- Septic Repairs within 500' of a Stream
- Septic Repairs within the Chesapeake Bay Critical Area

Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary
- Roads
- Streams
- Open Water

MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

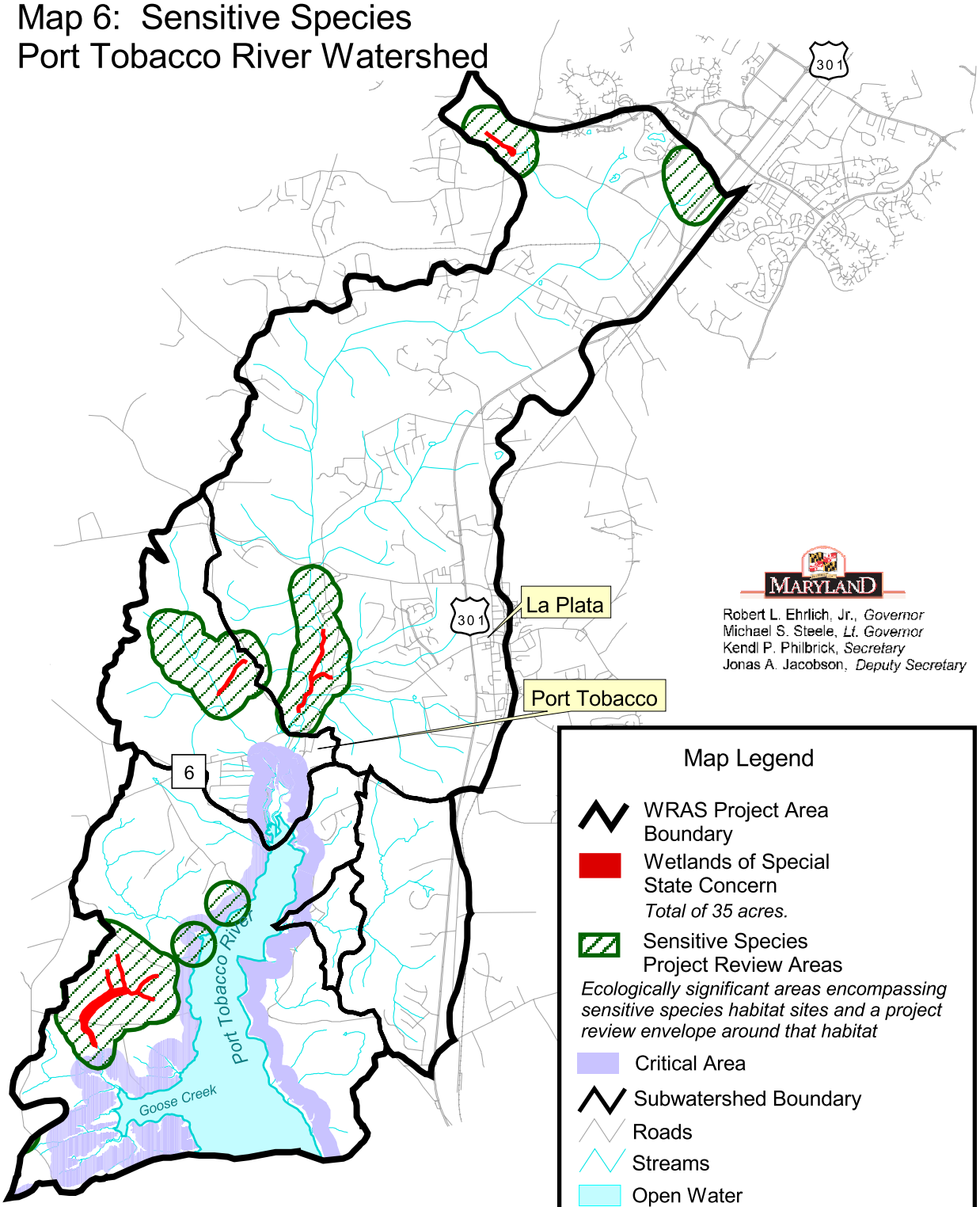
MDE

Map prepared by the Maryland Department of the Environment using data supplied by Charles County. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 2 Miles

Map 6: Sensitive Species
Port Tobacco River Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

- WRAS Project Area Boundary
- Wetlands of Special State Concern
  Total of 35 acres.
- Sensitive Species Project Review Areas
  Ecologically significant areas encompassing sensitive species habitat sites and a project review envelope around that habitat
- Critical Area
- Subwatershed Boundary
- Roads
- Streams
- Open Water

MDE

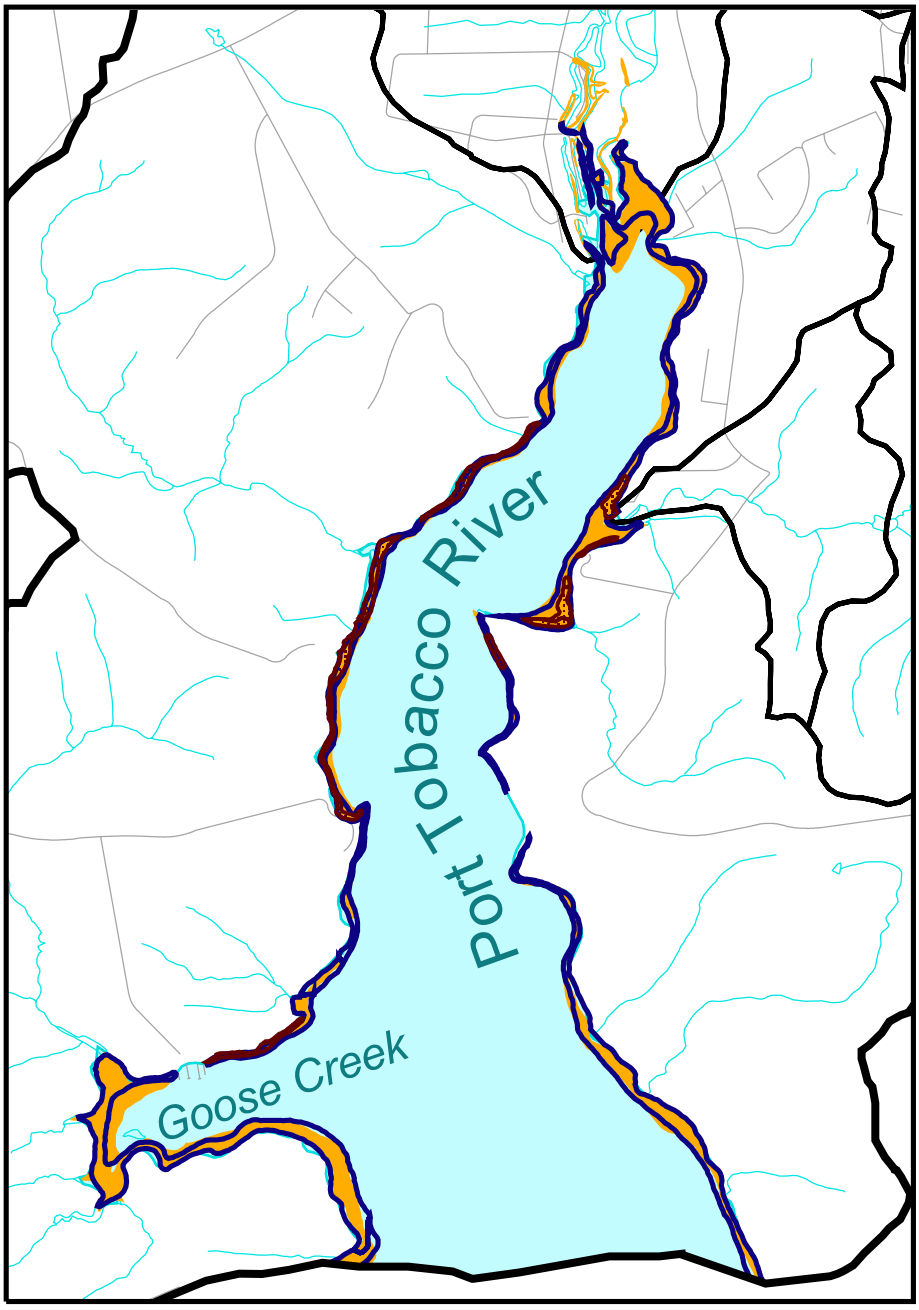
Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Natural Resources. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

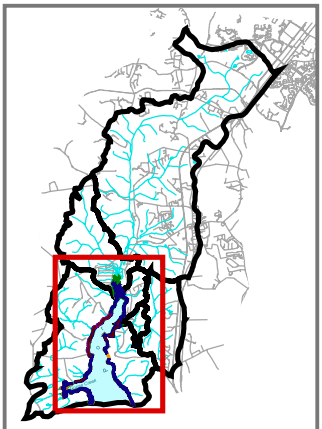
N

0 1 Miles

Scale: 1:91000

Map 7: Submerged Aquatic Vegetation
Port Tobacco River Watershed





Location

Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary

SAV Areas (acres)

- 1987 (274)
- 1997 (231)
- 2003 (31)
- Roads
- Streams
- Open Water

0 0.5 Miles

Scale: 1:22,000

MARYLAND

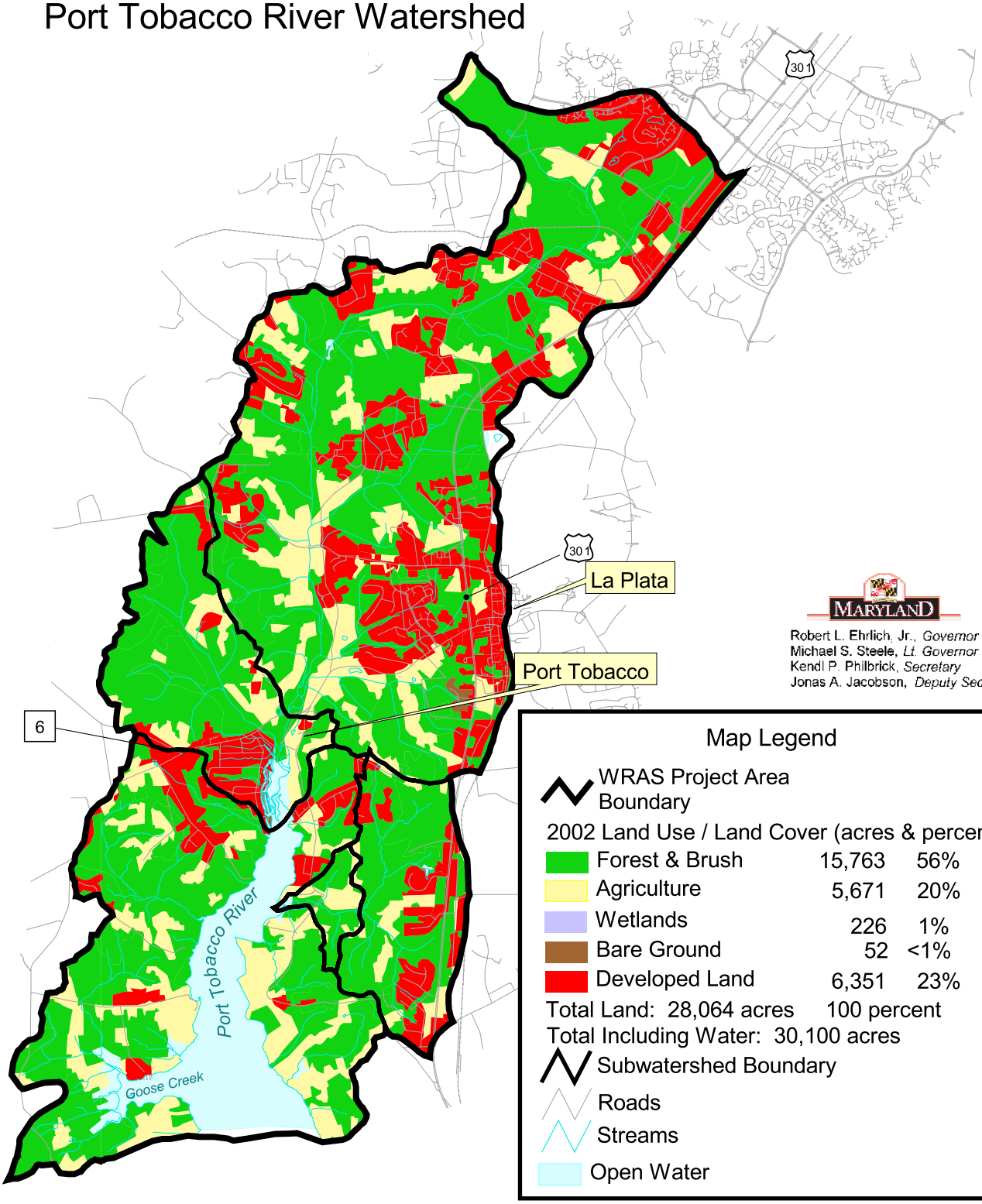
Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

MDE

Map prepared by the Maryland Department of the Environment using data provided by the Maryland Department of Natural Resources and the Virginia Institute of Marine Science. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

Map 8: Land Use / Land Cover
Port Tobacco River Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

WRAS Project Area Boundary

2002 Land Use / Land Cover (acres & percent)

Forest & Brush	15,763	56%
Agriculture	5,671	20%
Wetlands	226	1%
Bare Ground	52	<1%
Developed Land	6,351	23%

Total Land: 28,064 acres 100 percent

Total Including Water: 30,100 acres

Subwatershed Boundary

Roads

Streams

Open Water

MDE

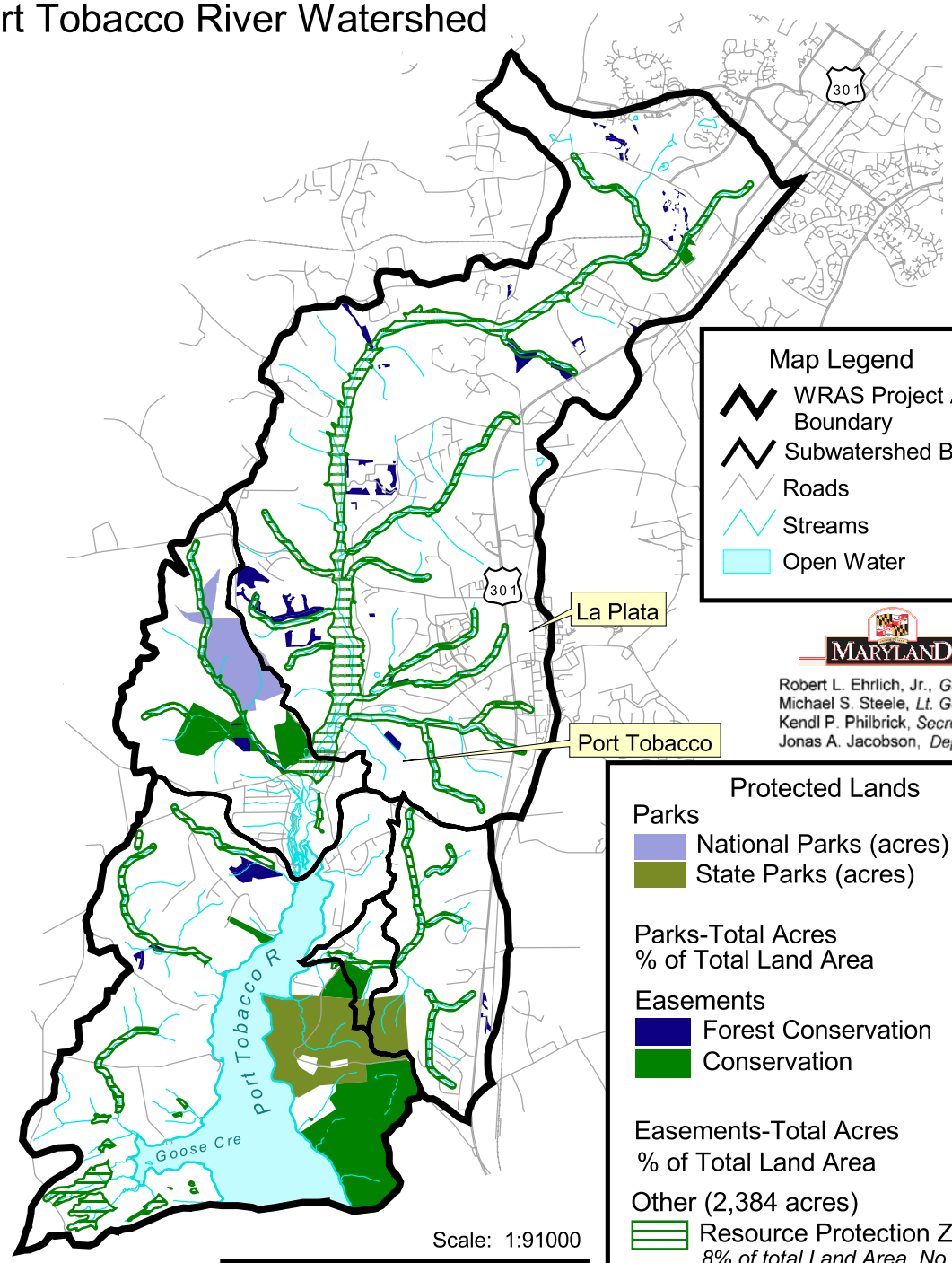
Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Planning and the Maryland Department of Natural Resources. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 1 Miles

Scale: 1:91000

Map 9: Protected Lands
Port Tobacco River Watershed



Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary
- Roads
- Streams
- Open Water

MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Protected Lands

Parks

National Parks (acres)	390
State Parks (acres)	843
Parks-Total Acres	1233
% of Total Land Area	4%

Easements

Forest Conservation	374
Conservation	1,191
Easements-Total Acres	1,566
% of Total Land Area	6%

Other (2,384 acres)

Resource Protection Zone
8% of total Land Area. No construction other than utilities and road crossings is permitted in the Resource Protection Zone.

Scale: 1:91000

0 1 Miles

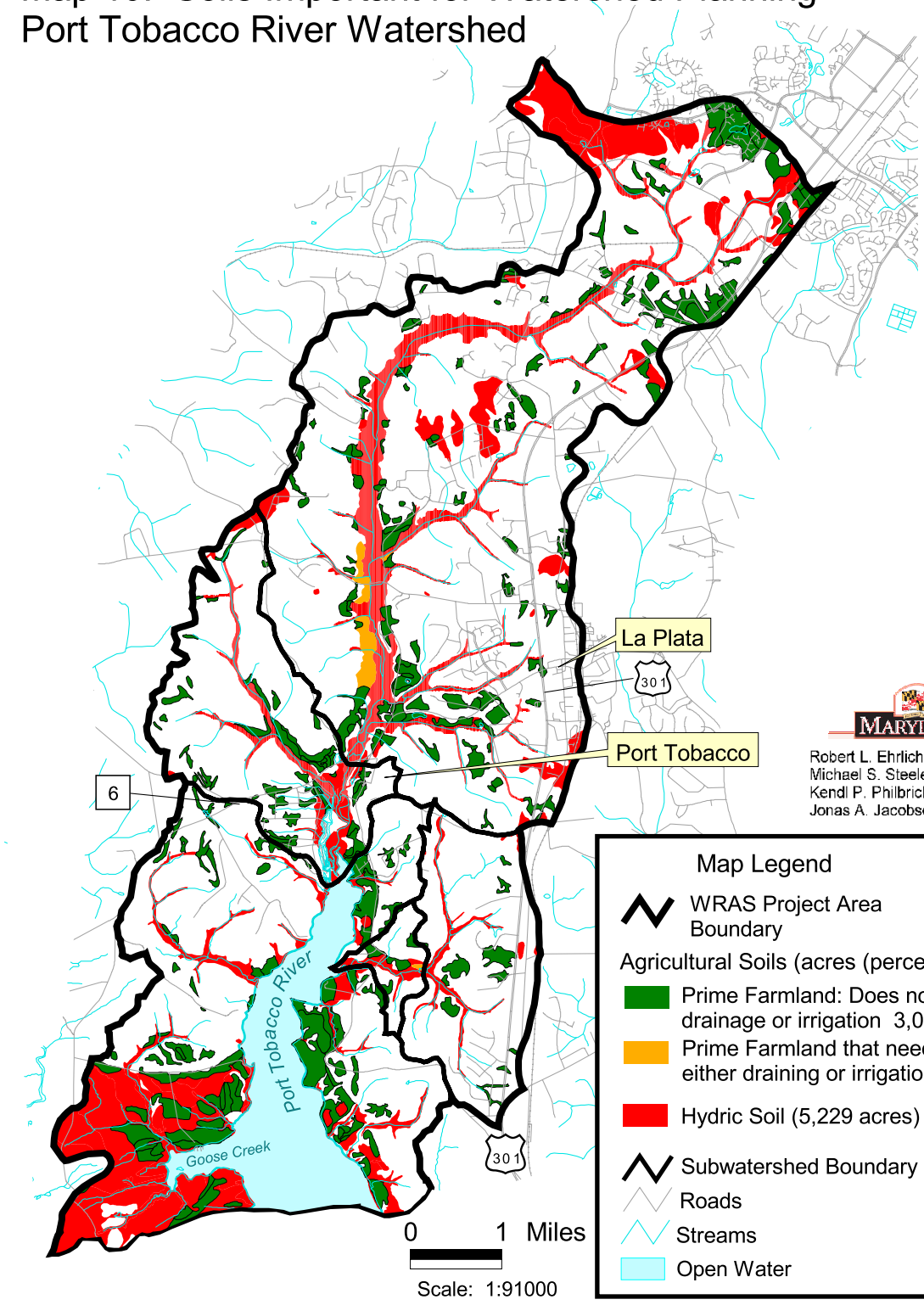
Total Land Area: 28,063 acres
(MDP 2002 LU / LC)

Map prepared by the Maryland Department of the Environment using data supplied by Charles County, the Maryland Department of Natural Resources and the Maryland Department of Planning.
The Roads layer is from Maryland State Highway Administration grid files.
For more information contact TARSA at 410-537-3906. (KFE 2005)

MDE

N

Map 10: Soils Important for Watershed Planning
Port Tobacco River Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

- WRAS Project Area Boundary

Agricultural Soils (acres (percent of all soils))

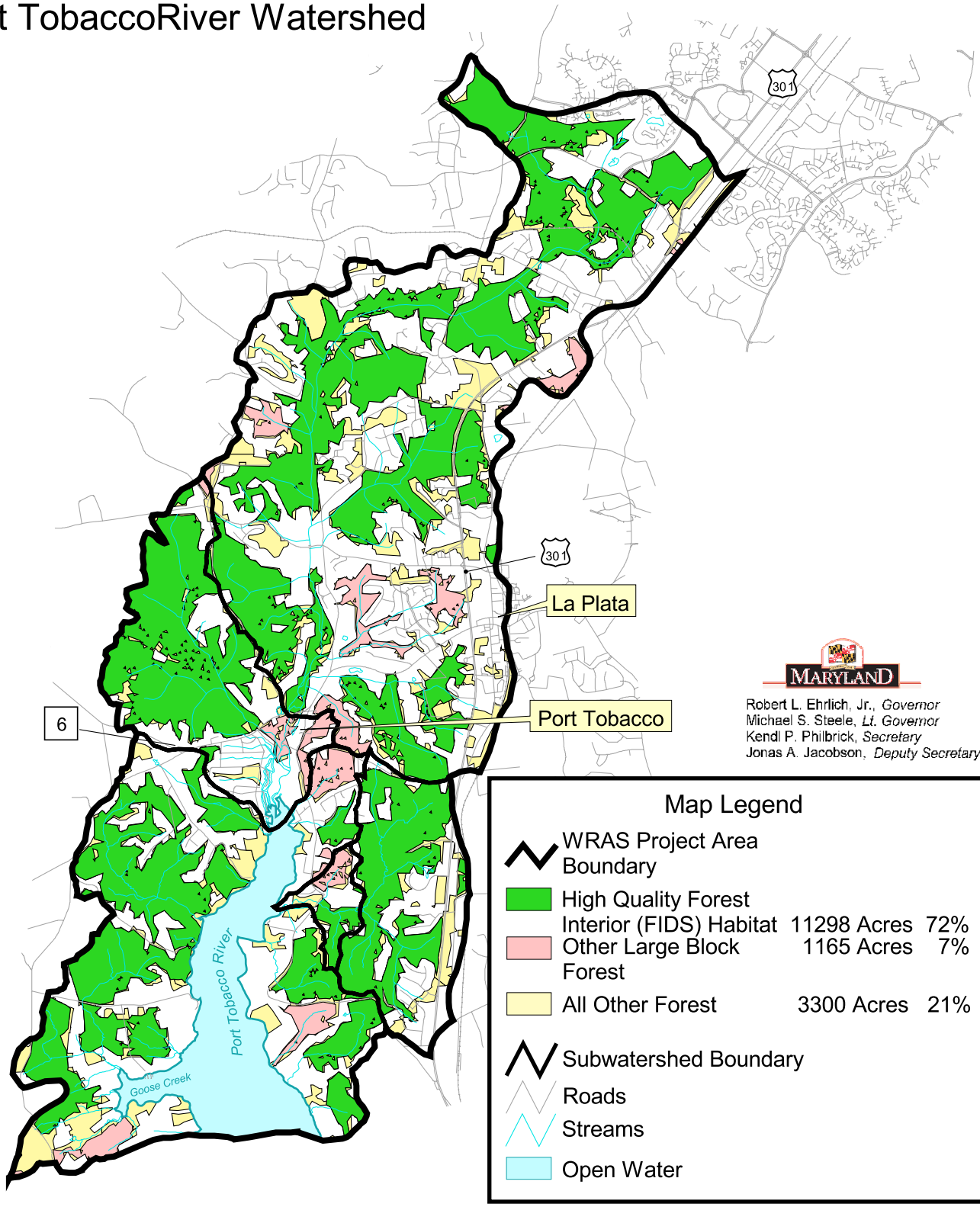
- Prime Farmland: Does not need drainage or irrigation 3,036 (10%)
- Prime Farmland that needs either draining or irrigation 124 (<1%)
- Hydric Soil (5,229 acres)
- Subwatershed Boundary
- Roads
- Streams
- Open Water

MDE

Map prepared by the Maryland Department of the Environment using data supplied by Charles County, Maryland, the United States Department of Agriculture and the Maryland Department of Natural Resources. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

Map 11: Large Block Forest Habitat
Port TobaccoRiver Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

Map Legend

WRAS Project Area Boundary		
High Quality Forest Interior (FIDS) Habitat	11298 Acres	72%
Other Large Block Forest	1165 Acres	7%
All Other Forest	3300 Acres	21%
Subwatershed Boundary		
Roads		
Streams		
Open Water		

MDE

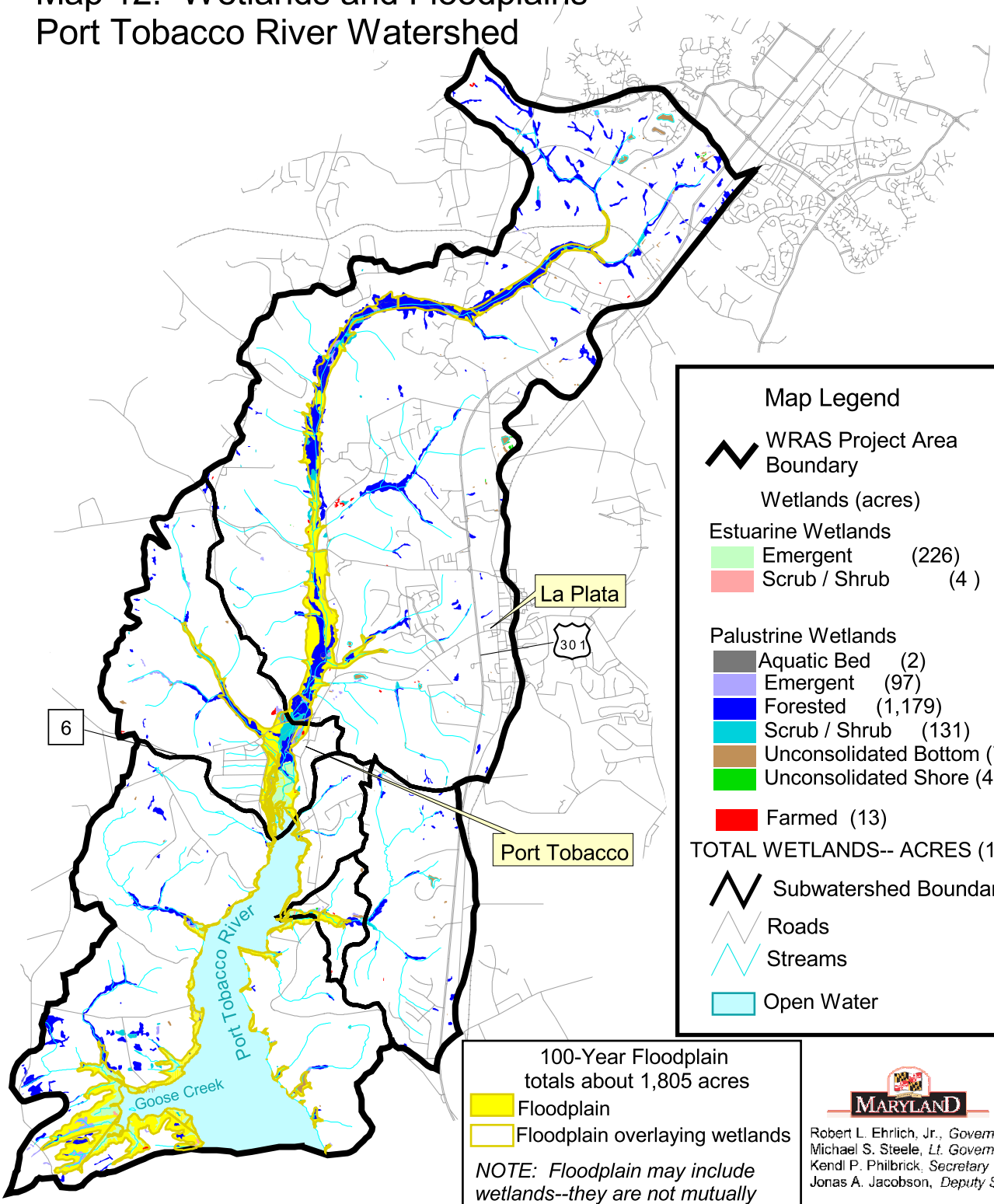
Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Planning and the Maryland Department of Natural Resources. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 1 Miles

Scale: 1:91000

Map 12: Wetlands and Floodplains
Port Tobacco River Watershed



Map Legend

WRAS Project Area Boundary

Wetlands (acres)

Estuarine Wetlands
- Emergent (226)
- Scrub / Shrub (4)

Palustrine Wetlands
- Aquatic Bed (2)
- Emergent (97)
- Forested (1,179)
- Scrub / Shrub (131)
- Unconsolidated Bottom (77)
- Unconsolidated Shore (4)
- Farmed (13)

TOTAL WETLANDS-- ACRES (1733)

Subwatershed Boundary

Roads

Streams

Open Water

100-Year Floodplain
totals about 1,805 acres

Floodplain

Floodplain overlaying wetlands

NOTE: Floodplain may include wetlands--they are not mutually exclusive.

MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

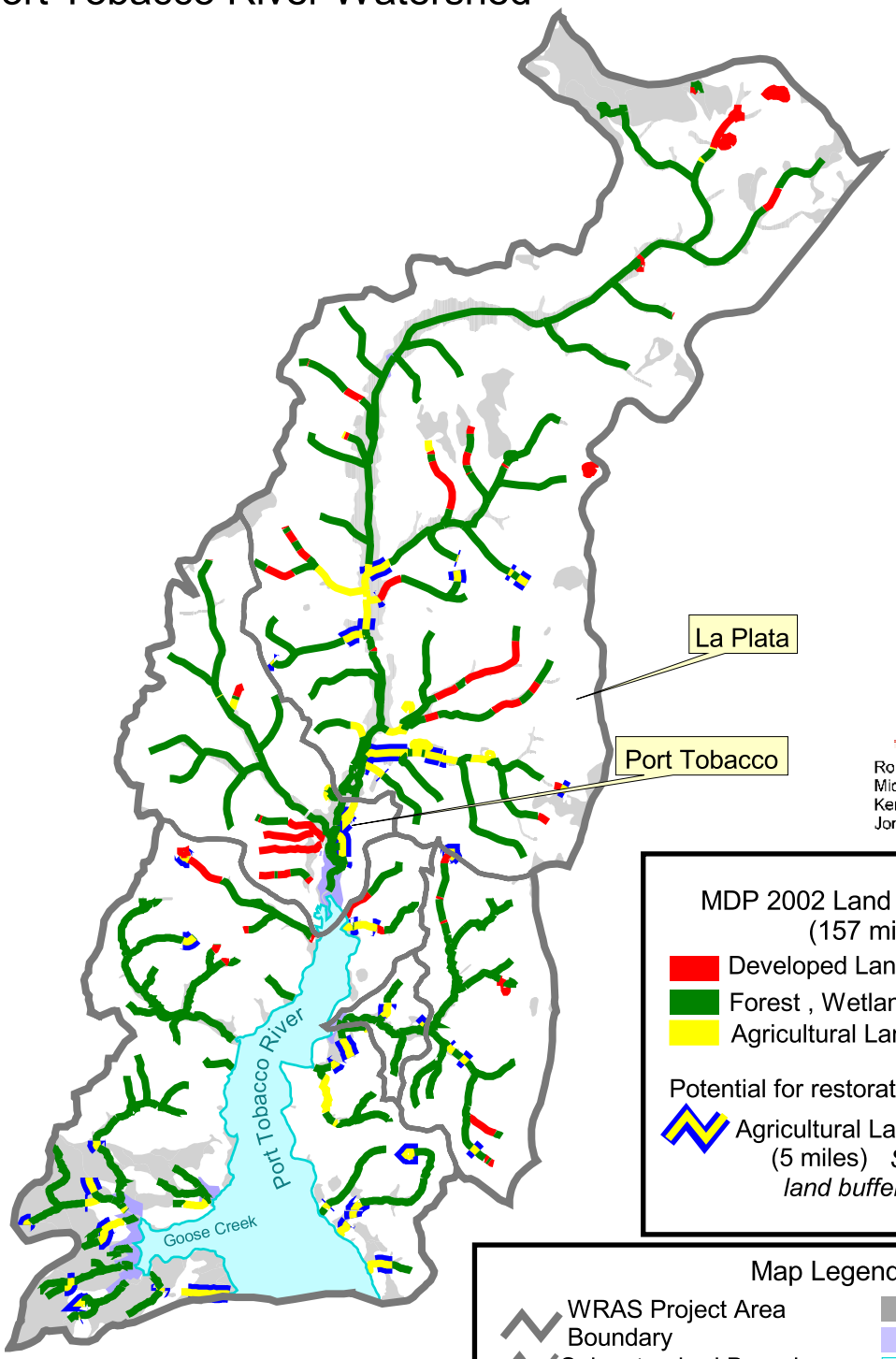
MDE

Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Natural Resources, the Federal Emergency Management Agency and the United States Fish & Wildlife Service. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 1 Miles

Map 13: Land Use / Land Cover at Stream's Edge
Port Tobacco River Watershed



MARYLAND

Robert L. Ehrlich, Jr., *Governor*
Michael S. Steele, *Lt. Governor*
Kendl P. Philbrick, *Secretary*
Jonas A. Jacobson, *Deputy Secretary*

MDP 2002 Land Use / Land Cover
(157 miles total)

- Developed Land (28 miles)
- Forest , Wetlands & Brush (97 miles)
- Agricultural Land (32 miles)

Potential for restoration of stream buffers:

- Agricultural Land on Hydric Soil (5 miles) *Subset of Agricultural land buffers.*

Map Legend

- WRAS Project Area Boundary
- Subwatershed Boundary
- Hydric Soil
- LU / LC Wetlands
- Open Water

Map prepared by the Maryland Department of the Environment using data supplied by the Maryland Department of Planning, the U. S. Department of Agriculture and the U. S. Environmental Protection Agency. The Roads layer is from Maryland State Highway Administration grid files. For more information contact TARSA at 410-537-3906. (KFE 2005)

N

0 1 Miles

Scale: 1:91000